UNIVERZA NA PRIMORSKEM
FAKULTETA ZA MATEMATIKO, NARAVOSLOVJE IN INFORMACIJSKE TEHNOLOGIJE

ZAKLJUČNA NALOGA

VPLIV GNOJENJA Z MINERALNO ORGANSKIM GNOJILOM NA ARBUSKULARNO MIKORIZO PRI PARADIŽNIKU *Solanum lycopersicum* L.

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Vpliv gnojenja z mineralno organskim gnojilom na arbuskularno mikorizo pri paradižniku *Solanum lycopersicum* L.

(Impact of fertilisation with mineral-organic fertiliser on arbuscular mycorrhiza in tomato *Solanum lycopersicum* L.)

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Izvleček: V poljskem poskusu smo testirali vpliv mineralno organskega gnojila na kolonizacijo korenin paradižnika (*Solanum lycopersicum* L.) z arbuskularnimi mikoriznimi (AM) glivami. Rastline smo gnojili z gnojilom BGA – Beijing Green Angel, (proizvajalca Beijing Green Angel Tehnology Co., Ltd. Beijing, Kitajska) ter uporabili komercialni mikorizni inokulum Symbivit proizvajalca Sybiom Ltd., Češka. V poskusu smo imeli 60 rastlin paradižnika. Te smo razdelili na štiri obravnavanja po 15 rastlin. Štiri testne skupine so bile: (1) z dodatkom gnojila, (2) z dodatkom inokuluma, (3) z dodatkom gnojila in inkoluma skupaj ter (4) kontrolna skupina brez dodatkov. V študiji smo merili naslednje parametre pri rastlinah: količino klorofila v listih z meritvami SPAD (Soil-Plant Analyses Development), skupno število in maso plodov po obravnavanjih ter naredili oceno kolonizacije korenin z AM glivami. Pri oceni kolonizacije korenin smo izmerili statistično značilno manjšo frekvenco kolonizacije korenin z AM glivami (F) pri obravnavanjih, kjer smo k tlom dodali gnojilo (1) v primerjavi z obravnavanji, kjer smo dodali inokulum (2). Kontrolni vzorec (4) in vzorec, kjer smo uporabili inokulum in gnojilo skupaj (3), pa se statistično ne razlikujeta od vzorcev z ločenimi dodatki gnojila (1) in inokuluma (2). Ugotovili smo tudi, da je dodatek gnojila (1 in 3), tudi v kombinaciji z dodatkom inokuluma v tla (2), značilno vplival na povečanje količine klorofila v listih paradižnika. Masa in število plodov sta bila največja, ko smo k tlom dodali gnojilo (1).

Key words documentation

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Abstract: In a field experiment, we tested fruit production in tomato plants (*Solanum lycopersicum* L.) treated with addition of mineral-organic fertiliser and arbuscular mycorrhizal (AM) fungal inoculum. We tested 60 plants in four separate treatments in which we used mineral-organic fertiliser BGA – Beijing Green Angel (product of Beijing Green Angel Technology Co., China) and AM fungal inoculum Symbivit (Sybiom Ltd., Czech Republic). Four test groups were set and consisted of 15 tomato plants each: (1) with fertiliser, (2) with inoculum, (3) with inoculum and fertiliser, and (4) a control group. The main objective of the test was to see the impact of fertilisation with mineral-organic fertiliser on arbuscular mycorrhiza development in tomato (*Solanum lycopersicum* L.). We measured leaf chlorophyll content with SPAD (Soil-Plant Analyses Development) meter, fruit number and mass, and we examined root colonisation with AM fungi. Frequency of AM fungal root colonisation (F) showed significant decrease only between treatments with organic fertiliser (1) and inoculum (2). Measurements with SPAD have shown an increase in the chlorophyll content with addition of fertiliser. Treatments with added fertiliser (1) were the most productive regarding tomato fruit mass and number.

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KAZALO VSEBINE

KAZALO PREGLEDNIC

KAZALO SLIK

KAZALO PRILOG

1 UVOD

V nalogi smo prikazali vpliv dodatka mineralno organskega gnojila (Beijing Green Angel – BGA, Beijing Green Angel Tehnology Co. Ltd., Kitajska) in komercialnega inokuluma z arbuskularnimi mikoriznimi (AM) glivami (Symbivit, Symbiom Ltd., CZ) na kolonizacijo korenin rastlin paradižnika (*Solanum lycopersicum* L.) z AM glivami, ter vpliv teh dodatkov na rast in rodnost rastlin. Poskus je bil izveden v rastni sezoni leta 2015 postavljen v Preski nad Kostrevnico, natančneje v nekaj let nerabljen del vinograda v katerem ni bilo več trt. V grede smo zasadili 60 rastlin paradižnika sorte 'novosadski jabučar', ki smo jih vzgojili iz semen. Te smo razdelili na štiri obravnavanja po 15 rastlin in sicer: (1) kontrola brez dodatkov, (2) z dodatkom gnojila, (3) z dodatkom inokuluma in (4) z dodatkom obeh. Spremljali smo količino in maso plodov paradižnika, merili količino klorofila v listih, kar kaže na vitalnost rastline, in ocenili kolonizacijo korenin z AM glivami.

Namen zaključne naloge je bil:

- oceniti kolonizacijo korenin paradižnika z mikoriznimi glivami in primerjati rezultate med obravnavanji,
- primerjati količino klorofila v listih rastlin med obravnavanji,
- primerjati količino in maso plodov paradižnika med obravnavanji.

Delovne hipoteze

- **H1** – ob dodajanju kombinacije mineralnega organskega gnojila in inokuluma bo zmanjšana kolonizacija korenin paradižnika z AM glivami.
- **H2** – pri obravnavanjih z dodatkom mineralnega organskega gnojila se bo povečala količina klorofila v listih rastlin.
- **H3** – dodajanje mineralnega organskega gnojila in inokuluma skupaj bo vplivalo na povečanje mase in količine plodov paradižnika.

1.1 Pregled objav

1.1.1 Mineralna prehrana rastlin

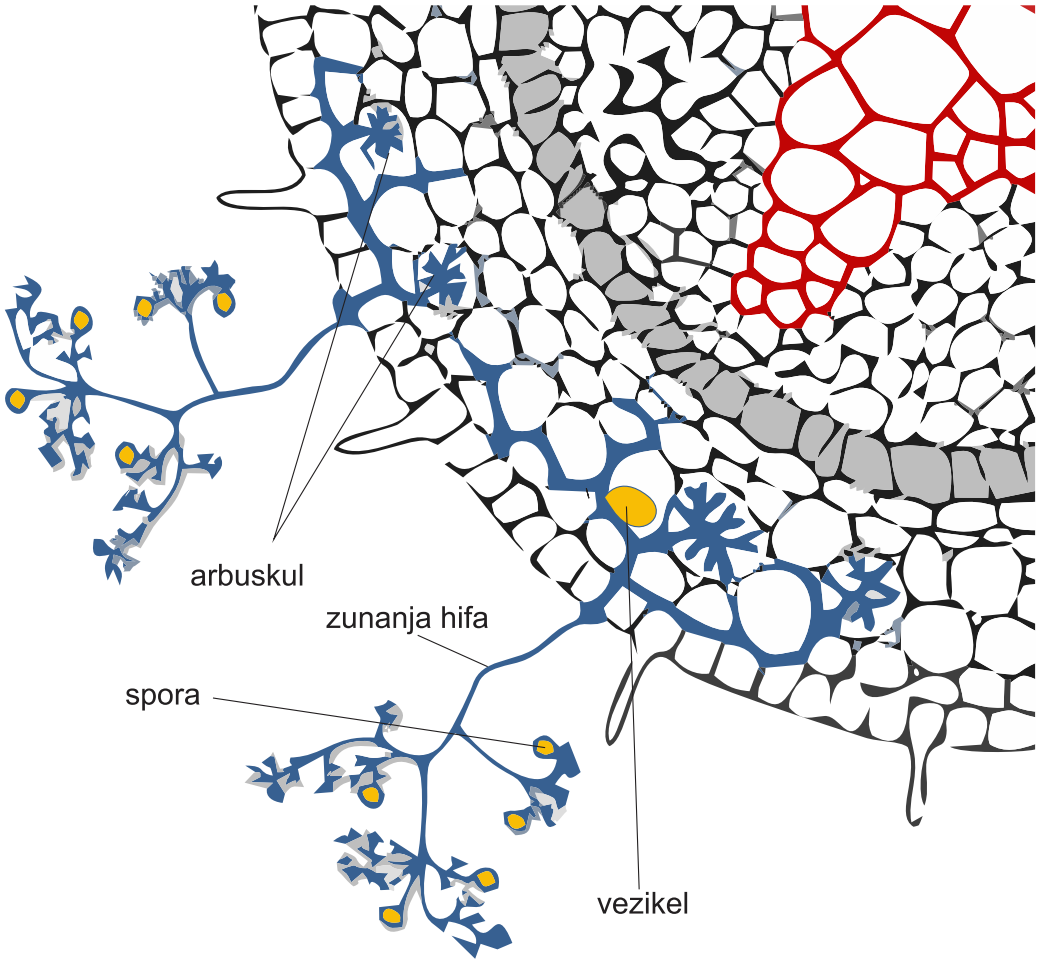
Tla so fiziološko, kemijsko in biološko zelo kompleksna komponenta ekosistemov. So heterogena, sestavljena iz organskih in mineralih komponent. Voda je medij za prenos raztopljenih mineralnih ionov v rastline. V prostorih med trdnimi delci tal so ujeti plini, ki predstavljajo plinski del tal. Korenine te prostore večinoma uporabijo za izmenjavo plinov (dihanje) (Ördög 2011). Ko voda preide v celice koreninskega laska, mora preiti skozi koreninski korteks do ksilema, ki potem vodo z minerali prevaja navzgor po rastlini. Rastline za svojo rast nujno potrebujejo esencialne elemente. Ti rastlini omogočijo normalen razvoj, ki je potreben za življenje. Nobenega od esencialnih elementov ne moremo odvzeti ali ga nadomestiti z drugim (Grusak 2001, Taiz in sod. 2002). Esencialne elemente lahko delimo na makroelemente (N, K, Ca, Mg, P, S, Si) in mikroelemente (Cl, Fe, B, Mn, Na, Zn, Cu, Ni, Mo) (Grusak 2001, Ördög 2011, Taiz in sod. 2002). Vse naštete elemente najdemo v tleh. Obstajajo še esencialni elementi, ki jih najdemo v tekočem in plinskem stanju, ti so vodik, kisik in ogljik. V rizosferi pa najdemo tudi mikorizne glive ter druge mikroorganizme, ki pomagajo rastlinam pri absorpciji mineralnih hranil (Taiz in sod. 2002) (glej poglavje 1.1.2).

Poleg razdelitve na makro- in mikrohranila pa delimo hranila tudi glede na njihovo biokemijsko vlogo in fiziološko funkcijo (Grusak 2001, Ördög 2011, Taiz in sod. 2002). Prvo skupino predstavljata dušik in žveplo, ki sta glavna elementa pri nastajanju organskih spojin. Dušik vpliva na produktivnost rastlin in je v večini omejujoči faktor pri razvoju. Večino (90 %) dušika iz tal porabijo glive, bakterije in rastline. Vključen je v glavne procese v celici in je gradnik nukleinskih kislin ter aminokislin. Nitrati se v listih vključujejo v procese fotosinteze v kloroplastih (Taiz in sod. 2002). Da povečane koncentracije nitratov v listih vplivajo na povečanje količine klorofila je bilo večkrat dokazano (npr. v študiji s krmno peso – *Beta vulgaris* L., Papasavvas in sod. 2008). Primerjali so meritve SPAD (Soil-Plant Analyses Development) z ekstrakcijo klorofila iz listov s fotospektrometričinimi meritvami. Ugotovili so, da fotospektrometrične meritve kažejo linearno korelacijo z meritvami SPAD (Papasavvas in sod. 2008). Žvepla v tleh večinoma ne primanjkuje in ima ključno vlogo pri presnovi v celicah, hkrati pa je gradnik koencimov in vitaminov (Ördög 2011, Taiz in sod. 2002). Druga skupina mineralnih spojin ima vlogo pri sintezi strukturnih in energetskih molekul. Te so fosfor, brom in silicij. Tretja skupina so kalij, natrij, magnezij, kalcij, mangan in klor, ki so v ionski obliki tudi v rastlini. Kalij in natrij v rastlini skrbita za uravnoteženje osmotskega potenciala. Četrta skupina je udeležena v elektronskem transportu in zanj odgovorni mineralni elementi so železo, cink, baker, nikelj in molibden (Ördög 2011, Taiz

in sod. 2002). Elementi, ki se po rastlini dobro prevajajo so N, K, Mg, P, Cl, Na, Zn in Mo. Imenujemo jih mobilni elementi. Ca, Fe, B so slabo mobilni elementi, ki se slabše prevajajo po rastlini (Taiz in sod. 2002).

1.1.2 Arbuskularna mikoriza

Mikoriza je simbioza med arbuskularnimi mikoriznimi glivami in rastlinami (Smith in Read 2008). Mikorizo delimo na štiri večje tipe, na podlagi strukture in funkcije. Ti so arbuskularna mikoriza, ektomikoriza, erikoidna mikoriza in orhidejska mikoriza (Van der Heijden in sod. 2015). Najbolj pogosta med njimi je arbuskularna mikoriza (Smith in Read 2008, Van der Heijden in sod. 2015). Arbuskularne mikorizne glive spadajo v deblo *Glomeromycota*, v katero spada več kot 300 vrst (Öpik in Davison 2016). AM glive kolonizirajo 80 % danes znanih rastlin (Smith in Read 2008, Varma 2008). Brez gostitelja ne morejo preživeti, saj nujno potrebujejo ogljik iz rastline. Eden od razlogov je, da glive začnejo tvoriti spore šele, ko kolonizirajo rastlino (Smith in Read 2008, Warnock in sod. 2007). Drugi dokaz so dobili z raziskavami, kjer so označevali ogljik, ki je prehajal iz rastline v hife AM gliv in v znotrajcelične strukture AM gliv. S tem so dokazali prenos ogljika (^{14}C) med rastlino in glivo.



Slika 1: Skica zgradbe AM glive.

Arbuskularna mikoriza vključuje več komponent: korenine gostitelja, znotrajkoreninske hife, ki preraščajo korenino med celicami koreninske skorje, fino razvejane hife (arbuskule) znotraj koreninskih celic in zunajkoreninski micelij v tleh. Zunaj koreninske hife tvorijo spore. Poleg tega pa se pri nekaterih vrstah gliv v korenini tvorijo tudi vezikli, ki služijo kot pomembni založen organ (vsebuje lipide) ali kot propagul za razširjanje glive (Smith in Read 2008).

Glavni viri kolonizacije korenin rastlin z AM glivami so njihove spore, možna pa je tudi nova kolonizacija iz predhodno koloniziranih korenin in hif. Predhodno kolonizirane korenine in hife predstavljajo tudi glavne komponente komercialnih inokulumov, vključno z inokulimom Symbivit (Symbiom Ltd., Češka) (Smith in Read 2008).

Pri simbiozi glive in rastline je pomembno kroženje hranil (Zhang in sod. 2011). Pomembnejši elementi v izmenjavi so ogljik, dušik in fosfor (Smith in Read 2008). Koreninski laski sproščajo v tla fosfataze in s tem povečajo dostopnost mineralne oblike fosforja za oba – rastlino in glivo. Na podoben način se poveča dostopnost tudi

mikroelementoma cinku in bakru. Poveča se tudi privzem dušika, ki ga lahko zadržijo celice rastline. Zaenkrat še ne poznamo razmerja med tem koliko hranil privzema rastlina preko glive in koliko preko neposrednega privzema s koreninami. Privzeta hranila stimulirajo rast, povečajo odpornost in sodelujejo pri obrambi rastlin pred stresom (Zhang in sod. 2011). Prisotnost fosforja v tleh pripomore k povečanju fosforja v paradižniku *Solanum lycopersicum* L. le ob prisotnosti AM gliv (Akhter in sod. 2015). V tleh je pomembna koncentracija in oblika fosforja (P), ki določa na kakšen način bodo AM glive vplivale na privzem fosforja v rastlino. Fosfor lahko delimo na organski (Po) in neorganski (Pi). Neorganski fosfor se veže z minerali oziroma tvori fosfate z Ca, Fe in Al ali pa se veže z delci gline v zemlji, kar ga naredi nedostopnega za rastline. Ko je ta raztopljen v vodni raztopini tal je dostopen za rastline. Največjo dostopnost za rastline Pi doseže pri pH okrog 6,5. V primeru, da je pH nižji od 6,5 se veže v spojino s Fe in Al. Če je višji od 6,5 se fosfatizira s Ca. Organski fosfor predstavljajo fitinska kislina, fosfolipidi in nukleidne kisline. Nekatere AM glive imajo sposobnost hidroliziranja Po spojin, poleg tega pa lahko vplivajo na produkcijo fosfataz v rastlinah. AM glive z absorpcijo P in prenosom v kolonizirane rastline zvišajo koncentracijo P v tkivu rastline (Smith in Read 2008).

AM glive se različno odzovejo na dodajanje organskih gnojil v njihovo okolje. Zhang in sod. (2011) so primerjali različne načine gnojenja tal in kolonizacijo korenin koruze (*Zea mays*) z inokulumom AM gliv, s steriliziranimi tlemi kot kontrolo. Pokazali so, da se v primerih dodajanja manjše koncentracije (0,5 g organskega gnojila na 1 kg tal) organskega gnojila privzem hranil poveča, prav tako se poveča masa celotne rastline. Poleg tega je bila povečana tudi kolonizacija korenin z AM glivami, kar bi lahko kazalo na večjo vlogo gliv na privzem hranil (tudi fosforja) in maso pridelka. Pri večji koncentraciji gnojila (2 g organskega gnojila na 1 kg tal), je v kombinaciji s prisotnostjo AM gliv prišlo do zmanjšanja absorpcije fosforja v primerjavi s kontrolo. Zaključili so, da ima koncentracija organskega gnojila v tleh ključno vlogo pri kolonizaciji korenin z AM glivami, oz. dodajanje visoke koncentracije fosfatnih gnojil tlom povzroči slabšo kolonizacijo korenin z AM glivami in s tem zmanjša njihovo vlogo pri privzemu hranil (Zhang in sod. 2011).

Pri poskusu z biooglјem in ozkolistnim trpotcem (*Plantago lanceolata*) so ugotovili, da se je kolonizacija korenin trpotca z AM glivami zmanjšala v primeru povišanega pH-ja. To so povezali s povečano koncentracijo dostopnega fosforja rastlinam v tleh ob dodatku biooglja z visokim pH (okoli pH 8 v vodi), predpogoj za to so tudi tla, ki imajo visok pH 8 (Warnock in sod. 2010). Predpostavljajo, da so rastline v takšnih razmerah manj odvisne od preskrbe hranil s strani AM gliv (Smith in Read 2008, Warnock in sod. 2010). Ne izključujejo pa verjetnosti, da stranski produkti pirolize na površini delcev oglja zavirajo rast AM gliv (Warnock in sod. 2010). Da bi dokazali eno in drugo hipotezo so potrebne še dodatne raziskave (Warnock in sod. 2010).

Znano je, da lahko dodatek biooglja ali komposta k tlom izboljša odpornost paradižnika proti nekaterim plesnim npr. listna luknjičavost – *Botrytis cinerea* in paradižnikovi pepelovki – *Levenillula taurica* (Akhter in sod. 2015). Tako kompost kot biooglje lahko spodbudita rast nekaterih mikroorganizmov v rizosferi. V vrhnjem delu tal pa najdemo tudi veliko AM gliv. Ko se te povežejo z rastlinam, lahko vplivajo na ostale mikroorganizme v tleh in na njihovo rast. Poleg tega simbioza med rastlinami in glivami spremeni presnovo rastlin in vpliva na zaščito rastlin pred patogenimi mikroorganizmi (Akhter in sod. 2015). Na primer, Akhter in sod. (2015) so odkrili povečano odpornost paradižnika *Solanum lycopersicum* L. na patogeno glivo *Fusarium oxysporum f.* sp. *lycopersici* ob dodajanju tako biooglja kot komposta.

1.1.3 Zakonodaja organskih in mineralnih gnojil v Sloveniji

Gnojila se delijo na organska in mineralna. Mineralna kasneje razdelimo na enostavna in kombinirana gnojila, njihovo uporabo, nadzor in tipizacijo obravnava Uredba evropskega sveta (Uredba ES št. 2003/2003). Enostavna mineralna gnojila se razdelijo po elementih na dušikova, fosfatna, kalijeva, magnezijeva in kalcijeva. Kombinirana mineralna gnojila se v grobem razdelijo na mešana in kompleksna. V Uredbi ES št. 2003/2003 so opisana gnojila mineralnega izvora, ter omejitve in vrednosti, ki jih uvrščajo v določeno skupino mineralnih gnojil. Vsa gnojila, ki ustrezajo omenjeni uredbi in so na seznamu v Prilogi I (Uredba ES št. 2003/2003), imenujemo »ES« gnojila. Gre za poenostavljen oziroma standardiziran sistem nadzora gnojil, ki se znajdejo na tržišču Evropske unije. V uredbi je predpisan tudi način podajanja vsebnosti primarnih hranil oziroma makrohranil, tj. dušika, fosforja in kalija. Vsebnosti se podajajo v elementarnih oblikah ali v oksidirani obliki npr. (P_2O_5, K_2O). Predpisane so tudi konstante za preračunavanje v elementarno obliko npr. (fosfor (P) = fosforjev pentoksid (P_2O_5) x 0,436). Če gnojilo vsebuje sekundarna hranila, je potrebno deklarirati tudi ta. Mednje sodijo: Mg, Na, S in Ca. Enako velja za mikrohranila: B, Co, Cu, Fe, Mn, Mo, Zn. S tem je poskrbljeno, da so morebitni kupci obveščeni o vsebnosti hranil, tako makro- kot mikrohranil v posameznem gnojilu. Vse količine so izražene v procentih.

Uredba je razdeljena na pet prilog. Priloga I (Uredba ES št. 2003/2003) določa seznam vseh gnojil »ES«, tukaj se gnojila razdelijo: po vsebnosti primarnih hranil (N, P, K), po tipu sekundarnega hranila, po fizikalno kemijskih lastnostih (tekoče) in po vsebnosti mikrohranil (B, Co...). V Prilogi II (Uredba ES št. 2003/2003) je seznam elementov, ki lahko odstopajo in v kolikšni meri. Gnojila, katerih visoka vsebnost dušika lahko povzroči eksplozijo, so posebej obravnavana v Prilogi III (Uredba ES št. 2003/2003). Analize in metode vzorčenja so določene v Prilogi IV (Uredba ES št. 2003/2003). V skladu z njimi morajo ravnati

laboratoriji, ki so pristojni za analize mineralnih gnojil. Če mineralno gnojilo ne ustreza seznamu Priloge I (Uredba ES, št. 2003/2003), lahko oddamo dokumentacijo za registracijo novega gnojila, ki se jo kasneje po presoji Evropske komisije lahko doda na ta seznam. Poleg tega Priloga V (Uredba ES št., 2003/2003) določa postopke za standardizacijo in akreditacijo laboratorijev, ki so pristojni za preverjanje ustreznosti gnojil ES. Če gnojilo ne ustreza Uredbi ES št. 2003/2003, kot na primer vsa organska gnojila in gnojila z bioogljem, potem so le ta lahko v prometu na ozemlju Republike Slovenije, če izpolnjujejo pogoje, ki jih določa Zakon o mineralnih gnojilih (Uradni list RS, št. 29/06 in 90/12) in Pravilnik o kakovosti mineralnih gnojil (Uradni list RS, št. 105/06). V Pravilniku o kakovosti mineralnih gnojil so predpisane minimalne vrednosti ter vsebnosti makrohranil in mikrohranil, ki jih lahko gnojila vsebujejo in njihova morebitna odstopanja, ki so še dovoljena (Uradni list RS, št. 105/06). Med mineralno organska se uvrstijo gnojila, ki poleg mineralnega dela vsebujejo tudi organsko snov, najmanj 10 % v suhi snovi; vsebnost makrohranil mora znašati najmanj 1 % N, 1 % P_2O_5 in 1 % K_2O.

1.1.4 Mineralno organsko gnojila

Mineralno organsko gnojilo je tisto, ki poleg mineralnih gnojil vsebuje tudi organsko snov živalskega ali rastlinskega izvora, ta gre čez proces kompostiranja (Uradni list RS, št. 29/06, 2006). Odpadki organskega izvora se lahko uporabijo v procesu kompostiranja, ki je eden glavnih procesov pri pridobivanju organskih gnojil (Mistra in sod. 2003). Kompostiranje je aeroben proces katerega glavna produkta sta CO_2 in voda, poleg tega pri tem procesu nastane humus. Za pridelavo komposta se uporabljajo urbani in ruralni odpadki. Med najbolj pogostimi so odpadki rastlinskega izvora, ki predstavljajo glavni vir ogljika. Uporabimo tako suhe kot sveže dele rastlin, zaradi razmerja med ogljikom in dušikom (Gomez in sod. 2006). Med ruralne odpadke spadajo tudi iztrebki živali – gnoj. Večinoma so uporabljeni iztrebki goveda, perutnine, konjev in prašičev v suhem ali tekočem stanju. Kot vir dušika se uporablja tudi urin živali (Bernal in sod. 2009). Odpadke organskega izvora, predvsem dele odmrlih rastlin, odlagamo na kup. Pred tem pa poskrbimo, da so v velikosti nekje od 1 cm do 3 cm. S tem pospešimo razgradnjo. Upoštevati je potrebno tudi optimalno razmerje med C/N za razgradnjo (Gomez in sod. 2006). Mikroorganizmi potrebujejo vir ogljika in dušika. Ustrezno razmerje med njima je 30:1 = C:N (Bernal in sod. 2009). To dosežemo tako, da na kup dodamo približno enako količino suhih in svežih rastlin. Če je razmerje C/N manjše, prihaja do pospešene produkcije amonijaka. Hlapenje amonijaka iz kupa pomeni izgubo dušika v končnem produktu (Bernal in sod. 2009, Gomez in sod. 2006). Potrebno je preprečiti, da bi se odpadki med seboj preveč sprijeli in s tem povzročili anaerobno razgradnjo. Slednje lahko dosežemo tako, da merimo dihanje mikroorganizmov – spremljamo količino porabljenega kisika oziroma proizvedenega ogljikovega dioksida (Gomez in sod. 2006). Poskrbeti moramo tudi za dovolj veliko vlažnost v kupu (idealna je

50 %). Naslednji pomemben parameter je prenos toplote. Mikroorganizmi, ki najhitreje razgrajajo odpadke, delujejo najbolje do temperaturnega maksimuma 71 °C. Pregrevanje preprečimo tako, da kupe prezračimo in s tem ohranimo bakterije pri življenju. To je zelo pomembno, saj pregrevanje povzroči odmiranje bakterij in razgradnja se začne od začetka. Nekje v dveh do treh tednih se uporabljene organske snovi spremenijo v rjavo organsko zmes – humus (Raabe 2001). Humificirani del tal v naravnem okolju pogojuje plodnost tal. Kakovost komposta se odraža v stopnji humifikacije (Bernal 2009). Humus se deli po topnosti na humične kisline, fluvične kisline in humin. Humin se močno veže s hidrofobnimi organskimi zmesmi, kar pomeni, da ni pod nobenimi pogoji topen v vodi (Baglieri in sod. 2007, Tadini 2015). Humične kisline niso topne v vodi, če je pH manjši od 2. Fulvične kisline pa so topne v vodi ne glede na pH (Baglieri in sod. 2007). Da bi čimprej dosegli željeno stanje, se poslužujemo tudi uporabe deževnikov, efektivnih mikroorganizmov, kultur, ki razgrajujejo celulozo, kemičnih dušikovih aktivatorjev in prezračevanja kupov. Na koncu pa organskim gnojilom lahko primešamo tudi biooglje (Čufer osebni stik 2016, Mistra in sod. 2003).

1.1.5 Biooglje

Že pred prihodom Evropejcev so staroselci v Amazoniji izboljševali rodovitnost tal z dodajanjem oglja (Lehmann 2006). Ni znano ali so to počeli namenoma, ali so bili to samo odpadki iz kurišč. Leta 1870 je geolog James Orton odkril dele črnih tal, ki so bili zelo rodovitni in so danes poznani pod imenom *terra preta*. Če je v njej veliko karbonskega oglja, ta spremeni kemične procese v tleh. Takšna tla lažje zadržijo nutriente npr. kalcij, fosfor, kalij. Tla so nastala z odlaganjem oglja na kupe, oglje je nastalo iz organskih odpadkov v pečeh z zelo malo kisika (Wayne 2012).

Biooglje je stranski produkt pirolize biomase in vsebuje visoke koncentracije ogljika. »Biochar« oziroma biooglje se razlikuje od oglja po uporabi (Lehmann 2006). Ko ga dodajamo tlom, se v pore oglja zaradi ostankov npr. sladkorjev, ujamejo mikroorganizmi, ki te sladkorje razgradijo. Od takrat naprej biooglje deluje kot mineralna komponenta in ne več kot organska. Glavna razlika med tlemi, katerim je bilo dodano biooglje in tistimi brez njega, je količina mikroorganizmov v tleh (Verhjeijn in sod. 2010). Poleg tega je pričakovano, da trajnostno zadržuje ogljik in izboljša sestavo tal. Pri tem naj ne bi škodoval okolju in človeku na dolgi ter kratki rok, dodaja Evropska komisija (Uredba ES št. 2003/2003). Problemi nastajajo pri dokazovanju dolgoročnih učinkov na okolje, ki bi jih lahko povzročila uporaba biooglja. Raziskave dolgoročnih učinkov še potekajo (Barrow 2011, Jones in sod. 2011, Kookana in sod. 2011).

Vstopna biomasa za pridelavo biooglja je lahko zelo različna in sicer gre lahko za lesene odpadke, kmetijske odpade, živalske in človeške odpadke, industrijske odpadke in odpadke iz voda (Kookana in sod. 2011, Tripathi in sod. 2016). Vsa ta vstopna masa ima določen vir elementov, ki so pomembni pri pridelavi biooglja. Biomasi lahko dodajajo vodo ali proces vodijo pri visokem tlaku. Vsaka snov ima različno količino organskih in neorganskih snovi zato lahko dobimo različne količine stranskih produktov (Tripathi in sod. 2016). Vstopna masa je tista, ki biooglju daje kemične značilnosti in zgradbo ter pogojuje kako bo ta reagiral s tlemi. Na vse omenjene lastnosti kritično vplivata temperatura in čas izpostavljenosti med pirolizo (Kookana in sod. 2011). Biooglje naj bi povečalo prisotnost mikoriznih gliv ter bakterij v tleh (Barrow 2011). Razlog za to naj bi bile mikropore v oglju (Barrow 2011, Kookana in sod. 2011). Te dajejo zavetje sporam mikoriznih gliv in jim tako omogočijo prednost pri razvoju pred ostalimi saprofiti (Lehmann 2006). Zaradi por v biooglju se poveča tudi zadrževanje vode v tleh (Barrow 2012, Kookana in sod. 2011). Pri okuženih tleh, tretiranih s pesticidi, zmanjša absorpcijo pesticidov v rastlino (Barrow 2012). Hranila, ki se topijo v vodi, so ob uporabi biooglja v rastlino sprejeta v večji meri, kar se odraža v povečani rasti nekaterih rastlin (Barrow 2012). Poveča se prisotnost deževnikov ter mikoriznih gliv (Barrow 2012).

Dodajanje biooglja tlom ima tudi negativne posledice. Lahko povzroči izgubo naravnega organskega materiala. Na primer: količino dekompozicijskih bakterij, kar lahko pomeni zmanjšanje razgradnje ogljika s pomočjo ostalih mikroorganizmov (Jones in sod. 2011).
Novejše raziskave kažejo, da biooglje v nekaterih tleh zavira rast AM gliv (Akhter in sod. 2015). V številnih primerih je biooglje lahko tudi potencialni vir toksičnih snovi, kot so policiklični aromatski ogljikovodiki (PAH-i), in nekaterih toksičnih kovin (npr. cink – Zn in baker – Cu) (Kookana in sod. 2011). PAH-i nastanejo pri gorenju biomase lesa v procesu pirolize, težke kovine pa so prisotne v vstopni biomasi npr. iztrebki perutnine. To je še posebej problematično, saj so npr. težke kovine v tleh nerazgradljive in se akumulirajo v okolju. Mikroporoznost biooglja vpliva na biodostopnost organskih snovi. Pri raziskovanju uporabe biooglja pri čebuli (*Allium cepa*) in ob uporabi dveh insekticidov so ugotovili, da se je ob prisotnosti biooglja v tleh podaljšal čas delovanja insekticidov. Na zastajanje fitosanitarnih sredstev v tleh lahko vpliva mikroporoznost biooglja ter morebitna prisotnost toksičnih snovi na oglju, na katero lahko vpliva način pirolize (Kookana in sod. 2011).

1.1.5.1 Piroliza

Piroliza je proces termokemične razgradnje v odsotnosti kisika med katero se biomasa segreje od 400 °C do 1250 °C (Kambo in Dutta 2015, Tripathi in sod. 2016).

Kemična reakcija pirolize:

$(C_6H_6O_6)n \rightarrow (H_2 + CO + CH_4 + \cdots + C_5H_{12}) + (H_2O + CH_3OH + CH_3COOH + \cdots) + C$

Pri pirolizi je pomembna temperatura in čas izpostavljenosti biomase postopku. Najpogosteje uporabljena je počasna piroliza. Relativno nizke temperature (pod 300 – 650 °C) in daljši čas izpostavljenosti povzročita, da iz biomase dobimo večje količine biooglja (Glaser in sod. 2002). Oglje pa ni edini produkt pirolize. Stranski produkti, ki nastanejo so bioolja ter plini, večinoma CO, CO_2, N_2 in H_2 (Kambo in Dutta 2015, Tripathi in sod. 2016).

Pirolizo delimo na primarno in sekundarno. V primarnem stadiju toplota odcepi molekule, ki so hlapljive. V tem stadiju se začnejo formirati tudi karboksilne, karbonilne in hidroksilne skupine, ki jih povzročijo procesi dehidracija, dekarbonizacija in dehidrolizacija. Ko se ti procesi zaključijo, nastopi ključni del pirolize: sekundarna piroliza. Glavni proces je razgradnja biomase do oglja in plinov. Prvi del produkta predstavljajo plini. Drugi del je mešanica različnih tekočin. Kot zadnji od produktov je biooglje (Tripathi in sod. 2016).

2 MATERIAL IN METODE

V raziskavi smo uporabili mineralno organsko gnojilo BGA – Beijing Green Angel ter komercialni inokulum Symbivit (Symbiom Ltd., CZ), ki vsebuje AM glive. Za testno rastlino smo izbrali paradižnik *Solanum lycopersicum* L., sorta 'novosadskega jabučarja'. Sadike smo vzgojili sami in jih po 21 dneh rasti v substratu posadili v grede. Te so bile locirane v vinogradu v Preski nad Kostrevnico (46°01'08.9"N, 14°54'33.2"E). Raziskovali smo vpliv gnojila, inokuluma, vpliv obeh dodatkov skupaj in za primerjavo imeli še kontrolno skupino brez dodatkov. Na obravnavanje smo posadili 15 rastlin paradižnika, skupaj 60 rastlin.

2.1 Gnojilo BGA (Beijing Green Angel Tehnology Co. Ltd., Kitajska)

Gnojilo s komercialnim imenom Beijing Green Angel, ki smo ga uporabili v poskusu je narejeno na Kitajskem in ga v EU še ni na tržišču. Proizvaja ga podjetje Beijing Green Angel Tehnology Co., Ltd. iz Beijinga. Kratica BGA pomeni Beijing Green Angel, in je hkrati ime tehnologije in komercialno ime produkta. Po zakonodaji ga opredelimo med mineralno organska gnojila. Po podatkih proizvajalca je gnojilo narejeno iz rastlinskih materialov, kot so razni deli odmrlih rastlin, žaganja, listja in koruznih storžev. Del postopka proizvodnje gnojila je fermentacija oziroma kompostiranje. Kompost se obdela še sintetično (obogatitev z minerali) in s postopki za dosego sposobnosti kontroliranega vnosa hranil v tla. Tehnologija pridelave tega gnojila je prejela veliko nagrad s strani kitajskega kmetijstva in Združenih narodov. Nagrajeni so bili za izjemne dosežke v kmetijstvu ter boju proti dezertifikaciji (brošura podjetja Beijing Green Angel Tehnology Co. Ltd. 2011; Priloga A).

Gnojilo je sestavljeno iz organskega dela in mineralnega dela. Sestavljajo ga dušik (3,38 %), fosfor (2,22 %) in kalij (3,67 %), ki predstavljajo mineralni del. Organski del predstavljata huminski in fulvični ogljik, skupno 50,3 %. pH gnojila je 8,3 (Poročilo o preskusu gnojila BGA Kmetijskega inštituta Slovenije – 2017; Priloga B).

2.2 Inokulum Symbivit (Symbiom Ltd., CZ)

Uporabili smo prilagojeno različico komercialnega inokuluma brez dodatkov. Slednjega sestavljajo izključno spore AM gliv, koščki koloniziranih korenin z AM glivami in naravna glina. Po podatkih proizvajalca inokulum vsebuje naslednje taksone AM gliv: *Rhizophagus irregularis, Funneliformis mosseae, Claroideoglomus claroideum* in *Funneliformis*

constrictus. Proizvod dodamo k tlom, ko presajamo rastline. Pomembno je, da dodamo inokulum v neposredno okolico korenin in tako omogočimo njihovo kolonizacijo z AM glivami.

2.3 Paradižnik (*Solanum lycopersicum* L.)

Solanum lycopersicum L. sortno ime za 'novosadskega jabučarja'. Spada v družino razhudnikovk (Solanaceae). Komercialno ime za seme te sorte je Supersweet 100 F1 (Royal Seeds). Plodovi rastejo v latih oziroma dolgih poganjkih. Velikost »češnjevih« plodov je od 2 do 3 cm v premeru. Sorta potrebuje veliko sonca in vode. Semena smo 4. 6. 2015 posadili v manjše posodice in jih vzgojili do velikosti 20 cm. Dne 18. 6. 2015 smo sadike presadili v tla. Ko so plodovi začeli zoreti (po 16. 8. 2015), smo jih na približno teden dni pobirali, jih prešteli in stehtali skupno maso plodov rastlin posameznega obravnavanja.

2.4 Lokacija poskusa (Preska nad Kostrevnico)

Poskus smo izvedli v kraju Preska nad Kostrevnico na nadmorski višina 564 m (46°01'08.9"N, 14°54'33.2"E). Poskus smo postavili v več let nerabljen del vinograda (slika 2). Trt v tem delu vinograda ni bilo več zato smo lahko zasadili paradižnik. Še prej smo morali tla prekopati, ter odstranili travno rušo. Ko smo to storili, smo pripravili grede za sajenje paradižnika. Uporabili smo vrstno razporeditev pred tem obstoječega vinograda. Tla so bila pod naklonom in tekom poskusa preraščena s travno rušo, ki smo jo redno kosili.

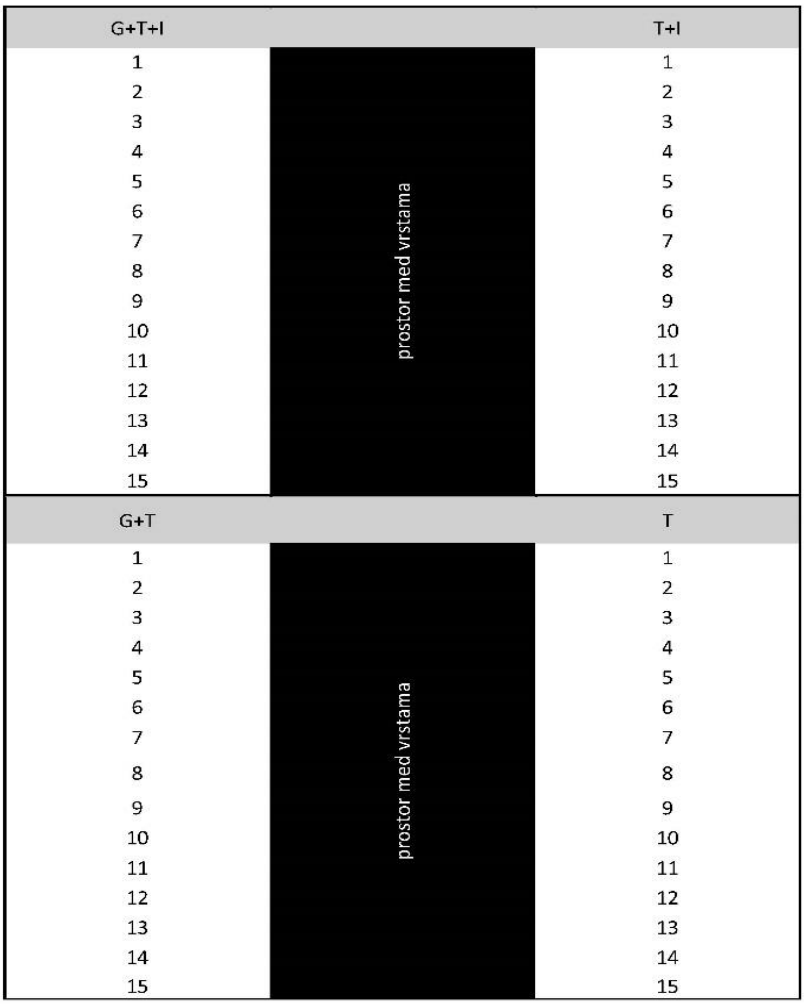
Slika 2: Preska nad Kostrevnico. Rdeča puščica prikazuje območje poskusa.

2.5 Poljski poskus in časovni potek meritev

V predhodno pripravljena tla nerabljenega vinograda smo zasadili paradižnike. Zaradi močnega sonca ob presajanju iz loncev v tla, smo jih prvi teden zaščitili pred direktnim soncem z vejami bukve. Ko smo jih presajali, smo vse zalili z enako količino vode (2 l). Rastline smo zalivali samo prvih 14 dni. Kasneje zaradi ugodnega vremena to ni bilo več potrebno. Rastline smo razdelili na štiri obravnavanja, kot je prikazano na sliki 3 in v preglednici 1.

Preglednica 1: Prikaz obravnavanj pri poskusu s paradižnikom.

Obravnavanje	Opis	Št. Rastlin	Oznaka	Inokulum	Gnojilo
I.	Tla + gnojilo BGA	15	T+G	/	20 g
II.	Tla + inokulum Symbivit	15	T+I	40 g	/
III.	Tla + gnojilo BGA+ inokulum Symbivit	15	T+G+I	40 g	20 g
IV.	Tla	15	T	/	/



Slika 3: Postavitev obravnavanj v vinogradu.

Slika 4: Postavitev poskusa v Preski nad Kostrevnico.

Območje vinograda smo izbrali zaradi večletne kmetijske neuporabe. Ker je bil naklon terena velik, smo obravnavanja z gnojilom postavili na eno stran. Rastline enakega obravnavanja (15 rastlin) smo sadili dne 18. 6. 2015 s 30 cm razmakom. Med vrstami so bila tla s travno rušo v širini 1 m. Ko smo sadike paradižnika posadili v grede, smo pri obravnavanjih z gnojilom uporabili 20 g gnojila BGA na rastlino. Gnojilo smo v sadilnih luknjah zmešali s tlemi in prekrili z ostankom tal. Pri dveh obravnavanjih, ki sta vsebovali mikorizni inokulum, smo dodali po 40 g inokuluma na rastlino. Preden smo rastlino posadili, smo tla posuli z inokulumom in ga prekrili s tlemi. Za tretje obravnavanje smo pripravili tla brez dodatkov.

Na rastlinah paradižnika smo izmerili vsebnosti klorofila z napravo SPAD (Soil-Plant Analyses Development, Spectrum Tehnologies Inc.) dne 25. 6. 2015, en teden po presaditvi v grede. Enajst tednov po presaditvi v grede (od 16. 8. 2015 do 13. 9. 2015) smo v 7-8 dnevnih intervalih obirali plodove, jih tehtali in prešteli. Enajst tednov po presaditvi v grede (16. 8. 2015) smo opravili tudi drugo meritev vsebnosti klorofila z merilcem SPAD.

Petnajst tednov po presaditvi v grede (20. 9. 2015) smo po 6 izbranih rastlin na obravnavanje izkopali. Korenine rastlin smo oprali v tekoči vodi in jih shranili v 70 % etanolu za kasnejšo oceno kolonizacije korenin z AM glivami.

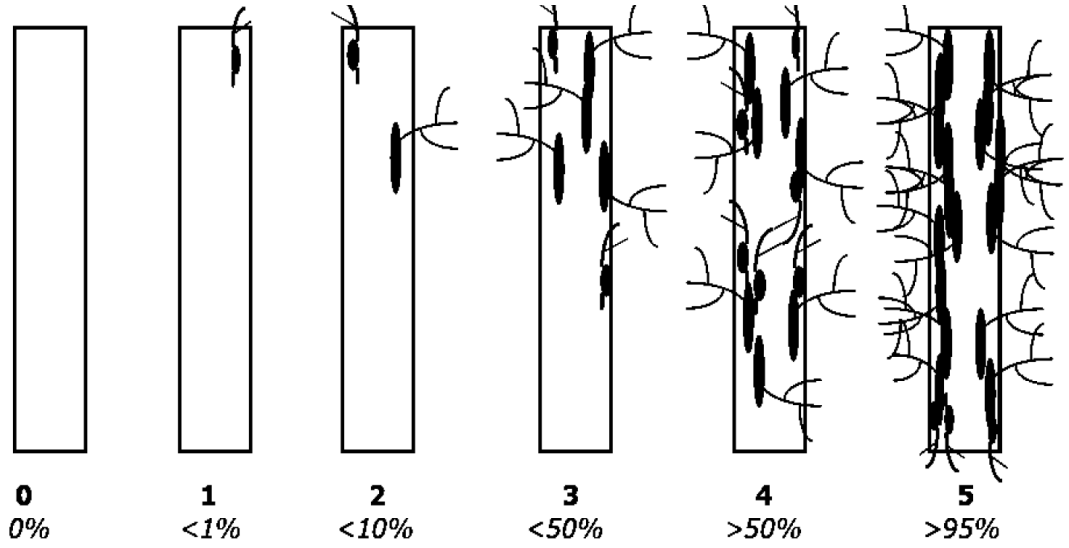
2.6 Merjenje klorofila (SPAD)

Za merjenje vsebnosti klorofila v listih smo uporabili napravo imenovano SPAD ali Soil-Plant Analyses Development (Rodriguez in Miller 2000). Gre za nedestruktivno metodo, pri kateri z napravo merimo količino klorofila v listu (Rodriguez in Miller 2000). Naprava snema pri dveh valovnih dolžinah, vrednosti pretvori v vrednost SPAD, ki so v linearni korelaciji z vrednostmi vsebnosti klorofila v listih, izmerjenimi z metodo kemijske ekstrakcije. Korelacija je opisana z vrednostmi $r^2 = 0,93$ in stopnjo zaupanja $P < 0,0001$. Pri merjenju je pomembno, da vzamemo notranji del lista (1 cm od roba), ter merimo vedno eno stran lista. Pri vsaki rastlini smo opravili 30 meritev. Iz dobljenih vrednosti naprava izračuna povprečno vrednost klorofila v rastlini. Rezultate povprečnih vrednosti uporabljajo tudi za določanje vsebnosti dušika v določenih rastlinah (Rodriguez in Miller 2000). Merjenji smo opravili v dneh 25. 6. 2015 in 16. 8. 2015.

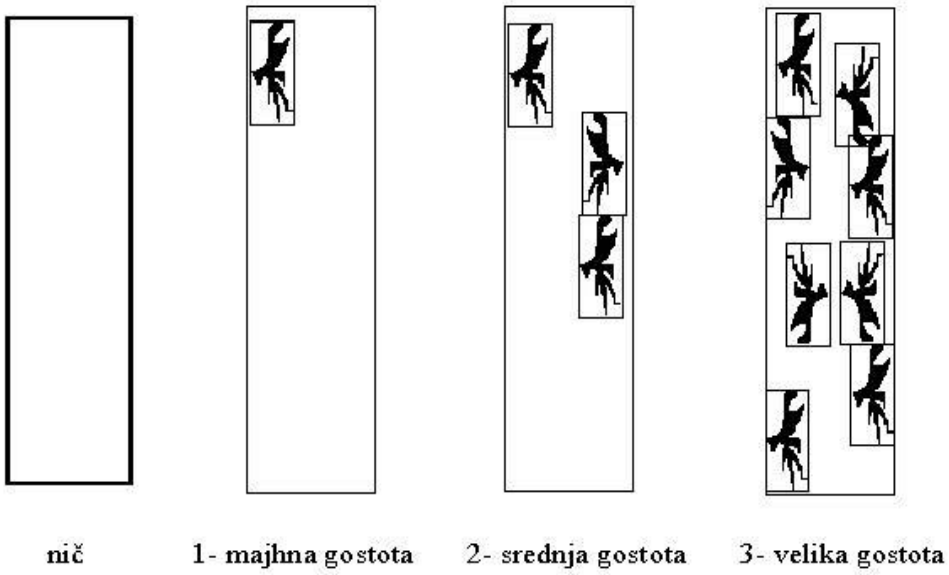
2.7 Ocenjevanje kolonizacije korenin paradižnika z AM glivami

Za oceno kolonizacije korenin z AM glivami smo uporabili korenine, hranjene v 70 % etanolu. Krajše koščke korenin (1 cm) smo dali v epruvete. Korenine smo sprali pod vodo, nato smo v epruvete dodali 10 % KOH in presvetljevali pri temperaturi 90 °C, pri čemer smo iz celic odstranili citoplazmo. Pri tej temperaturi smo korenine pustili 20 minut. Za tem smo korenine ponovno sprali z vodo. Nato je sledilo zakisanje v 1 N HCl, 5 min pri sobni temperaturi. Po zakisanju smo dodali raztopino 0,05 % tripan modro v laktoglicerolu. Laktoglicerol je raztopina glicerola, mlečne kisline in vode v masnem razmerju 80 : 40 : 40. To smo postavili v sterilizator za 5 minut pri 90 °C. Po obarvanju glivnih struktur z barvilom, smo korenine sprali in shranili v laktoglicerolu pri 4 °C do ocene kolonizacije. Kolonizacijo korenin z AM glivami smo ocenjevali pod mikroskopom po metodi, ki so jo opisali Trouvelot in sod. (1986) (povzeto po Maček 2004). Za vsak vzorec smo pripravili 3 objektna stekla in na vsako dodali po 10 koščkov korenin v velikosti 1 cm, ter kapljico laktoglicerola (povzeto po Maček 2004). Na koncu smo jih pokrili s krovnim stekelcem. Shema: 4 obravnavanja, 6 vzorcev na obravnavanje, 3 objektna stekelca na vzorec in 10 koreninic na objektno stekelce.

Za oceno kolonizacije korenin z AM glivami smo sledili dvema parametroma: kolonizaciji v razredih od 0 do 5 in gostoti arbuskulov A0 do A3.



Slika 5: Ocena gostote AM gliv.



Slika 6: Gostota arbuskulov AM gliv.

Ti podatki so bili podlaga za računanje naslednjih parametrov kolonizacije korenin z AM glivami: frekvence delov korenin z glivo – F (%), intenzitete mikorize – M (%), intenzitete mikorize v koloniziranih delih korenin – m (%), gostote arbuskulov v delu korteksa z

mikorizno kolonizacijo – a (%) in gostote arbuskulov v koreninskem sistemu – A (%) (povzeto po Maček 2004).

Formule za izračun parametrov so naslednje (povzeto po Maček 2004):

- **Frekvenca delov korenin z glivo**

F (%) = (število mikoriziranih korenin / število vseh korenin) *100

F (%) vrednost odraža razpoložljivost propagulov AM gliv v tleh.

- **Intenziteta mikorizne**

M (%) = (95 n_5 + 70 n_4 + 30 n_3 + 5 n_2 + n_1) / (število vseh korenin)

Kjer je n_5, n_4, n_3, n_2 in n_1 število fragmentov razvrščenih v posamezni razred.
M (%) nam daje informacijo, kolikšen del koreninske skorje celotnega koreninskega sistema je koloniziran z AM glivami.

- **Intenziteta mikorize v koloniziranih delih korenine**

m (%) = M * (število vseh korenin) / (število mikoriziranih korenin) = M * 100 / F

m (%) nam pove, kolikšna je infektivnost glive, tudi če glivnega inokuluma v tleh (F %) ni veliko.

- **Gostota arbuskulov v delu korteksa z mikorizno kolonizacijo**

a (%) = (100 m A3 + 50 m A2 + 10 m A1) / 100

Kjer je: m A3 = [(95 n_5 A3 + 70 n_4 A3 + 30 n_3 A3 + 5 n_2 A3 + n_1 A3) / št. mikoriziranih korenin] * 100 / m

n_1 A3, n_2 A3, …, n_5 A3 = število fragmentov z gostoto arbuskulov v razredu A3 v posameznih razredih za mikorizno kolonizacijo. a (%) je gostota arbuskulov v delu korteksa z mikorizno kolonizacijo. Odraža potencial mikoriznih simbiontov in kaže nivo fiziološke kompatibilnosti.

- **Gostota arbuskulov v koreninski skorji**

A (%) = a * (M / 100)

A (%) je gostota arbuskulov v koreninskem sistemu, kvalitativna ocena mikorize »*in situ*«.

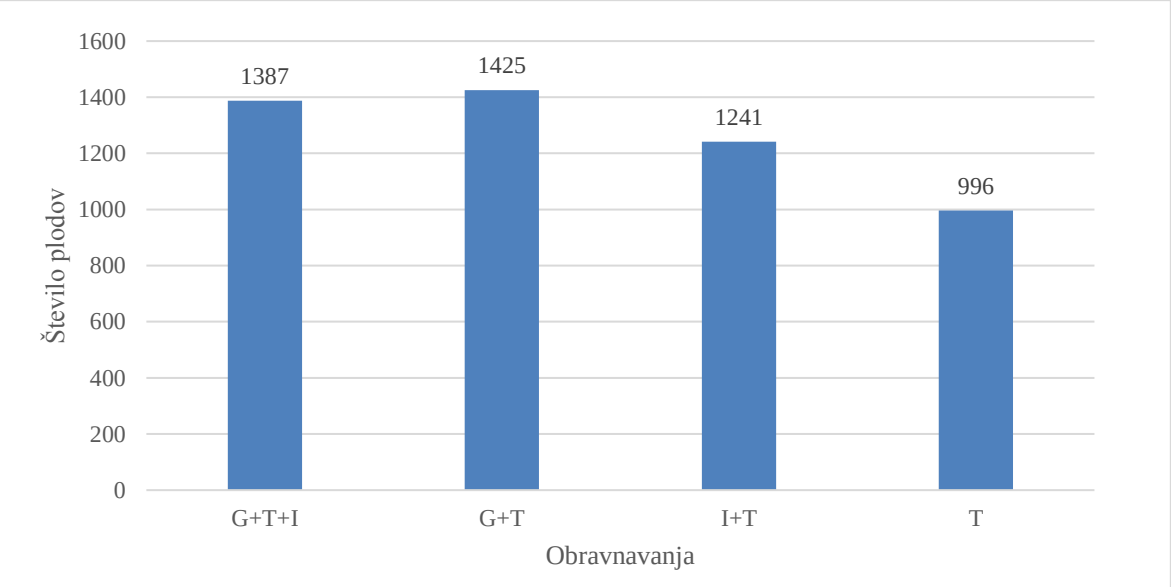
2.8 Analiza podatkov

Vse analize smo opravili v programu R 3.3.1. s knjižnico Rcmdr (R Core Team 2012). Za analizo smo uporabili podatke iz merjenj vsebnosti klorofila v listih in ocene kolonizacije korenin z AM glivami. Za izračun dobljenih rezultatov smo uporabili statistiko ANOVA. Z enosmerno analizo ANOVA smo dobili rezultate med posameznimi obravnavanji, uporabili smo en faktor. S Tukey-evim testom smo natančneje izračunali morebitne statistične razlike med obravnavanji. Razlike, ki so statistično pomembne, smo v rezultatih prikazali kot različne črke (preglednica 2 in 4). Uporabili smo tudi dvosmerno ANOVA in pri tem upoštevali dva faktorja, gnojilo in inokulum. Rezultati so prikazani v preglednici 3. Edini podatki, ki niso bili analizirani z naštetimi postopki so bili podatki o količini plodov paradižnika, saj so bili združeni po obravnavanjih.

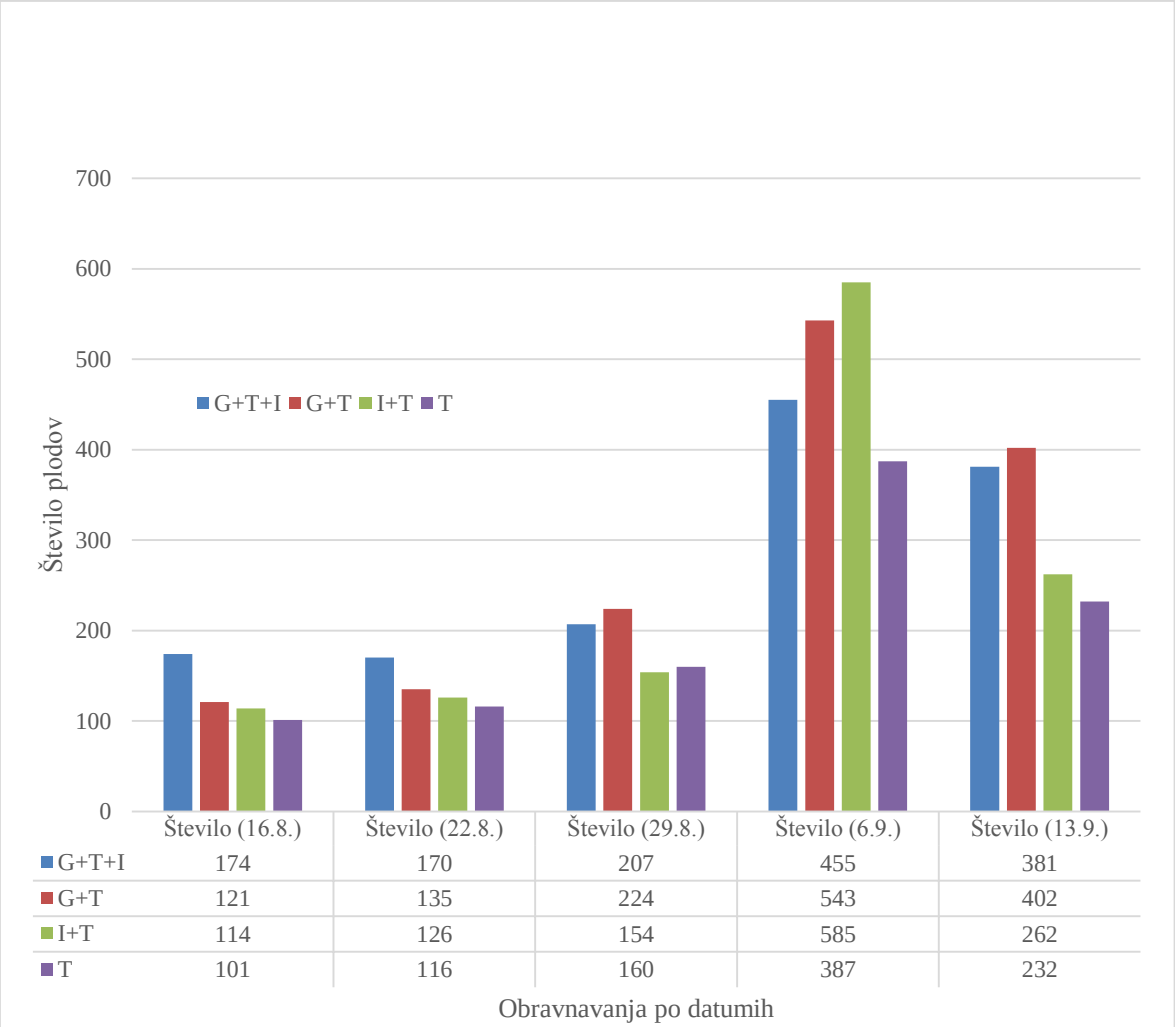
3 REZULTATI IN DISKUSIJA

3.1 Količina plodov paradižnika

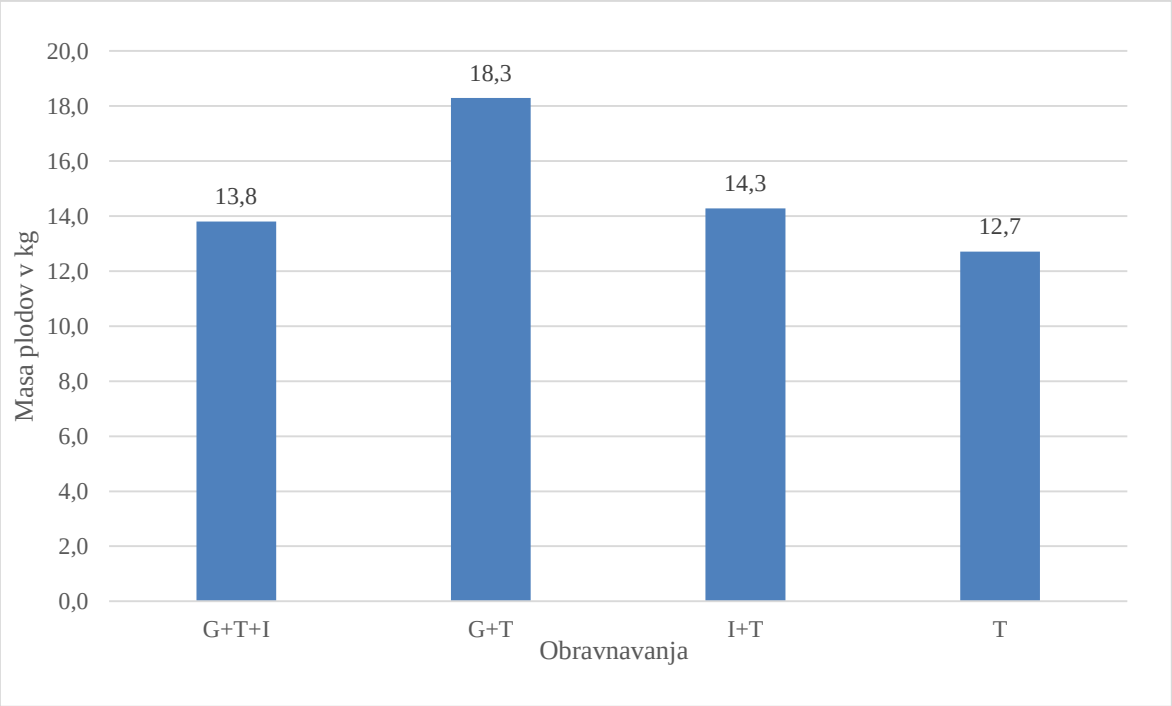
Masa in število plodov paradižnika sta nam pokazala, da ima na produkcijo plodov največji vpliv gnojilo. Meritve mase in števila plodov smo zaradi tehničnih omejitev izvedli za vseh 15 ponovitev na obravnavanje skupaj. Posledično statistična analiza mase plodov po obravnavanjih ni mogoča. Največ plodov paradižnika po masi in številu je pripadlo rastlinam, ki so bile samo gnojene (obravnavanje G+T). Najmanj plodov paradižnika po številu in masi je pripadalo rastlinam pri obravnavanju T, kot lahko vidimo na slikah 7 in 9. V primerjavi z obravnavanjem T smo pri obravnavanju G+T+I opazili za 39 % več plodov, pri obravnavanju G+T za 43 % več plodov in pri obravnavanju I+T za 25 % več plodov. Pri masi plodov smo, primerjavi z obravnavanjem T, v obravnavanju G+T+I videli 9 % večjo maso, pri obravnavanju G+T za 44 % večjo maso in pri obravnavanju I+T 12 % večjo maso. Obravnavanje G+T je doseglo najboljše rezultate in sicer ima za 44 % večje število plodov in za 43 % večjo skupno maso plodov v primerjavi s kontrolno skupino (T).



Slika 7: Slika prikazuje končno (skupno) maso plodov po obravnavanjih v petih tednih: gnojenje + inokulum + tla (G+T+I), gnojenje + tla (G+T), inokulum + tla (I+T), tla (T).



Slika 8: Grafični prikaz števila plodov paradižnika po obravnavanjih: gnojenje + inokulum + tla (G+T+I), gnojenje + tla (G+T), inokulum + tla (I+T), tla (T).

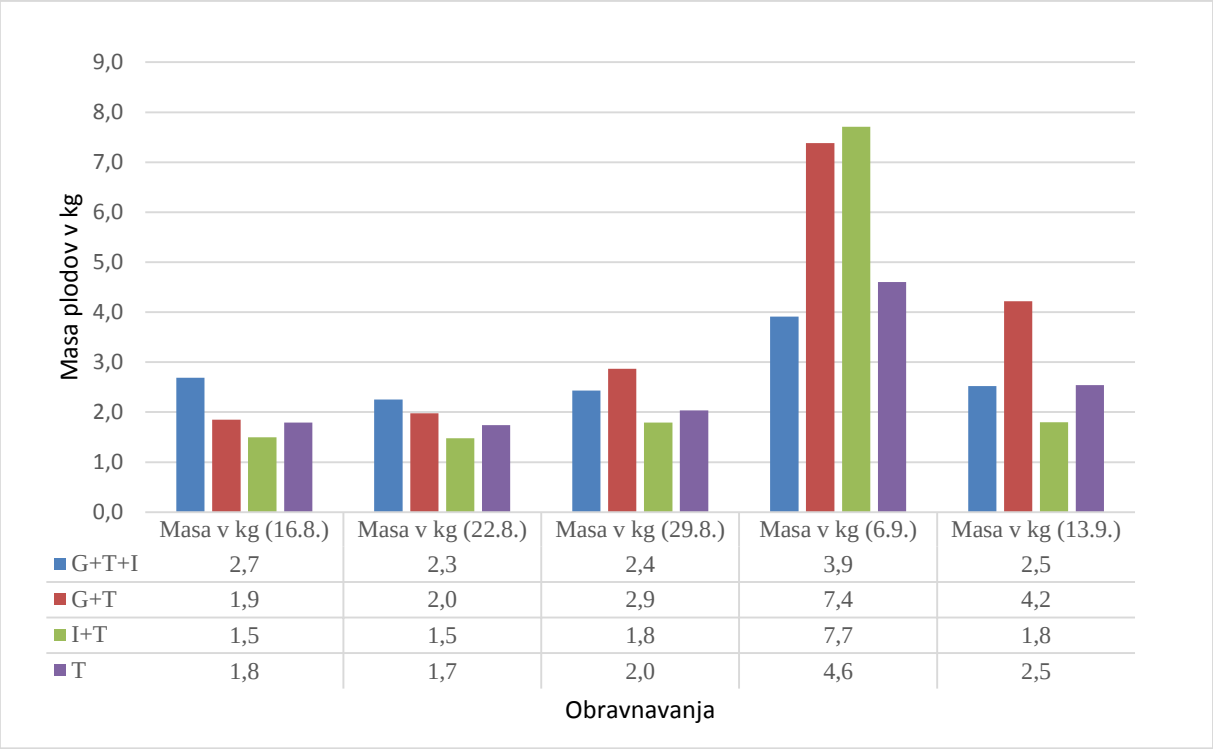


Slika 9: Grafični prikaz skupne mase plodov v kg v petih tednih po obravnavanjih: gnojenje + inokulum + tla (G+T+I), gnojenje + tla (G+T), inokulum + tla (I+T), tla (T).

Največje število plodov je bilo pri rastlinah, kjer smo k tlom dodali gnojilo (G+T). Obravnavanji z največjo maso plodov sta G+T in I+T (sliki 9 in 10). Na podlagi teh rezultatov lahko ovržemo našo hipotezo H3, kjer smo pričakovali, da bo dodatek gnojila in inokuluma skupaj imelo največji vpliv na povečanje mase in količine plodov, saj sta obravnavanji z ločenim dodatkom inokuluma (I+T) in gnojilom (G+T) imeli večjo maso in količino plodov kot obravnavanje G+T+I.

Iz slik 8 in 10 je razviden najbolj produktiven teden po presaditvi rastlin (4. teden, 6. 9. 2015). V tem tednu so vse rastline po obravnavanjih dosegle svoj maksimum v številu in masi plodov. Največ plodov, tako po masi kot številu, smo zabeležili pri obravnavanju I+T (7,7 kg), sledi pa mu obravnavanje G+T (sliki 8 in 10).

Obravnavanje G+T+I je imelo v 4. tednu najmanjšo maso paradižnika. Možni sta dve razlagi. Prvič, da smo v tla dodali preveliko količino gnojila za rastline z dodanimi AM glivami. Sodeč po rezultatih, ki jih je dobil Zhang s sod. (2011) je gnojilo spremenilo pH tal, kar je vplivalo na absorpcijo hranil in na zmanjšanje kolonizacije AM gliv. Druga, bolj verjetna razlaga je, da je na zmanjšanje mase plodov pri obravnavanju G+T+I (4. teden, 6. 9. 2015) vplivalo povečanje obolelih rastlin (štiri rastline), kar lahko vidimo na sliki 10. Pri ostalih obravnavanjih so obolele ena do dve rastlini.



Slika 10: Prikaz mase plodov paradižnika po obravnavanjih v kilogramih po obravnavajih: gnojenje + inokulum + tla (G+T+I), gnojenje + tla (G+T), inokulum + tla (I+T), tla (T).

3.2 Vsebnost klorofila v listih paradižnika

V preglednici 2 je prikazno povprečje 30 meritev SPAD in standardne napake razdeljeno po obravnavanjih G+T+I (gnojenje + inokulum + tla), G+T (gnojenje + tla), I+T (inokulum + tla) in T (tla). Različne črke ob rezultatih prikazujejo statistično značilne razlike med vzorci ($p < 0,05$).

Pokazali smo, da dodatek gnojila, tudi v kombinaciji z dodatkom inokuluma k tlom, statistično značilno poveča količino klorofila v listih paradižnika. Statistična analiza podatkov kaže razlike med dodatkom gnojila (G+T+I, G+T) in obravnavanjem kjer smo dodali inokulum (T+I) (preglednica 2 in 3). Kot so dokazali Papasavvas in sod. (2008), imajo največji vpliv na koncentracijo klorofila v rastlinah nitrati oz. dušik. Dodano gnojilo BGA je vsebovalo 3,38 % dušika v organski in amonijski obliki. Slednje je v našem poskusu statistično značilno vplivalo na povečanje količine klorofila pri obravnavanjih z gnojenjem oz. vrednost SPAD. Korelacija med meritvami SPAD in vsebnostjo klorofila v listih rastlin je bila večkrat potrjena (Papasavvas in sod. 2008). Sodeč po dobljenih rezultatih, lahko potrdimo našo hipotezo H2 o povečanju količine klorofila ob dodatku mineralno organskega gnojila oziroma zaradi dodatka dušika k tlom.

Preglednica 2: Prikaz vsebnosti klorofila (meritve z merilcem SPAD) po obravavanjih: G+T+I (gnojenje + inokulum + tla), G+T (gnojenje + tla), I+T (inokulum + tla) in T (tla).

Obravnavanja	Količina klorofila (SPAD vrednosti)	Število ponovitev
G+T	690,5 ± 38,4 [b]	15
G+T+I	691,1 ± 60,1 [b]	15
T	665,3 ± 53,2 [ab]	15
T+I	651,3 ± 62,7 [a]	15

Preglednica 3: Dvosmerna ANOVA analize SPAD vrednosti klorofila.

Obravnavanja	tla	inokulum
tla	665,3 ± 53,2	651,3 ± 62,7
gnojilo	690,5 ± 38,4**	691,1 ± 60,1**

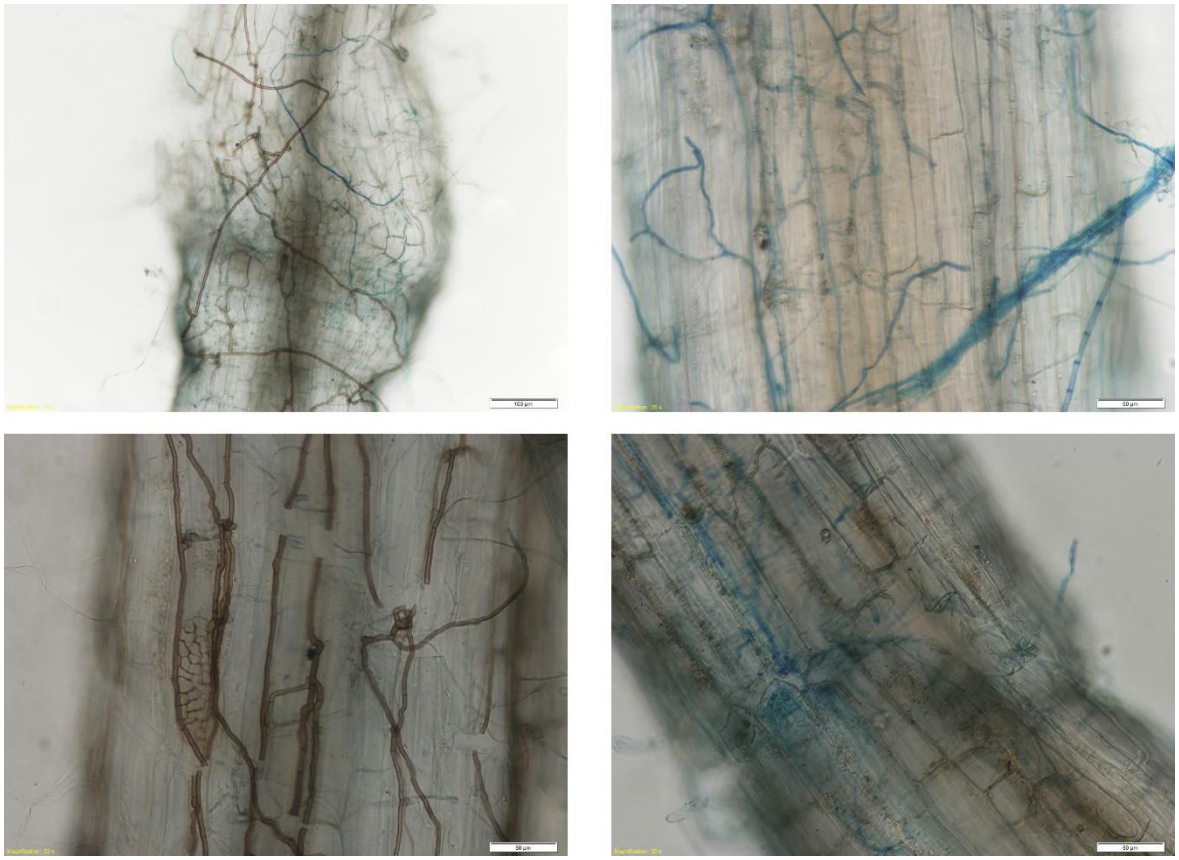
**statistično značilne razlike

3.3 Ocenjevanje kolonizacije korenin z AM glivami

Pri oceni kolonizacije korenin z AM glivami so se statistično značilne razlike pokazale samo pri frekvenci koloniziranosti rastlin z glivo F (%). Uporabljena statistika v preglednici 4 je enosmerna ANOVA, enake črke pomenijo, da ni statistično značilnih razlik ($p < 0,05$). Rezultati so pisani s standardnimi odkloni. a (%) – gostota arbuskulov v delu korteksa z mikorizno kolonizacijo, A (%) – gostota arbuskulov v koreninski skorji, F (%) – frekvenca korenin z glivo, m (%) – intenziteta mikorize v koloniziranih delih rastline, M (%) – prisotnost mikorize in n – število ponovitev. Razlike v frekvenci delov korenin z glivo so bile med obravnavanji I+T in G+T (preglednica 4), kar pomeni, da je pri obravnavanju z dodatkom inokulumom (I+T) statistično značilno večja frekvenca AM gliv v primerjavi z obravnavanjem, kjer smo dodali gnojilo (G+T). Kontrolni vzorec (T) in vzorec, kjer smo uporabili inokulum in gnojilo skupaj (G+T+I), pa se statistično ne razlikujeta od vzorcev z ločenimi dodatki gnojila in inokuluma. Na podlagi teh dveh ugotovitev lahko sklepamo, da dodatek gnojila negativno vplival na kolonizacijo korenin z AM glivami. Zaključimo lahko, da je prišlo do bistvenega zmanjšanja frekvence kolonizacije korenin z AM glivami v primeru uporabe gnojila, kar potrdi našo prvo hipotezo H1.

Preglednica 4: Parametri kolonizacije korenin z AM glivami.

Obravnavanja	a (%)	A (%)	F (%)	m (%)	M (%)	n
gnojilo + inokulum + tla (G+T+I)	3,1 ± 6 [a]	0,8 ± 1,8 [a]	49,7 ± 20,7 [ab]	16,8 ± 17,2 [a]	9,1 ± 10 [a]	15
gnojilo + tla (G+T)	0 [a]	0 [a]	43,7 ± 18,0 [a]	9,3 ± 5,1 [a]	4,0 ± 2,3 [a]	15
inokulum + tla (I+T)	5,6 ± 6 [a]	2,0 ± 3,7 [a]	77,6 ± 14,6 [b]	26,4 ± 23,7 [a]	22,4 ± 22,6 [a]	15
Tla (T)	0,8 ± 2 [a]	0,1 ± 0,2 [a]	61,6 ± 26,4 [ab]	7,8 ± 6,0 [a]	5,4 ± 4,6 [a]	15



Slika 11: Na levi strani sta sliki obravnavanja G+T+I, na desni pa sta sliki obravnavanja I+T.

Pri ocenjevanju kolonizacije korenin z AM glivami smo bili pozorni na modro obarvane AM glive. Poleg tega smo opazili, da se je pri vzorcu G+T+I povečalo število temnih septiranih endrofitov (DSE); opazili smo jih tudi pri ostalih vzorcih vendar ne v takšnem številu kot pri teh vzorcih (slika 11 – levi sliki). Septirane endrofite smo opazili tudi v kontrolnem vzorcu, tako da smo izključili verjetnost kontaminacije tal z gnojilom. Pod mikroskopom vidni kot rjavo obarvane glive.

Povemo lahko še, da so bili vzorci G+T in G+T+I zaradi tehničnih zapletov pri pripravi vzorcev manj reprezentativni, saj so se v več primerih celice koreninskega korteksa ločile od centralnega cilindra korenine. Korenine smo zaradi količine razdelili na dve barvanji.

Prvič (T+I in T) smo uporabil širše epruvete, drugič (G+T+I in G+T) tanjše, ker bi lahko zaradi prenatrpanosti prišlo do poškodb celic.

3.4 Bolezni paradižnika

V 4. tednu je prišlo do največjih razlik med obravnavanji. Dodaten razlog za razlike v rezultatih so obolele rastline zaradi plesni *Phytophthora infestans* (slika 12) pri obravnavanju G+T+I. V tem času so bile pri obravnavanju G+T+I obolele 4 rastline, pri ostalih obravnavanjih pa največ 2 rastlini. To je lahko vplivalo na rezultate, ki so vidni na slikah 4 in 5. Uporaba fungicida za preprečitev razširjanja krompirjeve oz. paradižnikove plesni *Phytophthora infestans* ni bila mogoča, saj bi ta v tleh lahko zavrl rast AM gliv. Teden po zadnjem merjenju količine plodov so vse rastline začele obolevati. Plesen se je razširila po vseh rastlinah ne glede na obravnavanje. V naši študiji ne moremo reči, da so bile rastline iz katerega od obravnavanj bolj odporne na bolezni. Za razliko od Akhter in sod. (2015), ki so opazili večjo odpornost paradižnika na druge vrste plesni ob dodatku tako biooglja kot komposta.

Slika 12: Krompirjeva oz. paradižnikova plesen *Phytophthora infestans* na steblu paradižnika.

4 ZAKLJUČEK

- Poskus na paradižniku *Solanum lycopersicum* L. je pokazal, da so bile rastline paradižnika gnojene z organsko mineralnim gnojilom BGA bolj produktivne tako v količini kot masi plodov.

- Vsebnost klorofila v listih paradižnika je bila statistično značilno večja, kjer smo uporabili organsko mineralno gnojilo BGA tudi v kombinaciji z dodatkom inokuluma.

- Frekvenca AM gliv je bila največja, ko smo uporabili inokulum v primerjavi z uporabo gnojila, kjer je bila frekvenca AM gliv najmanjša. Sklepamo lahko, da gnojilo negativno vpliva na kolonizacijo korenin z AM glivami.

V naši študiji smo torej ugotovili, da uporaba gnojila pozitivno vpliva na rast in produktivnost rastlin paradižnika, obenem pa smo zaznali, da je uporaba gnojila negativno vplivala na vzpostavitev mikorize.

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PRILOGE

Priloga A

BGA土壤调理剂 BGA soil conditioner

(BGA土壤激活剂 BGA soil activator)

北京绿天使科技有限公司

Beijing Green Angel Technology Co.,Ltd

目　　录

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1 北京绿天使科技有限公司简介

北京绿天使科技有限公司其前身是 1996 年 11 月成立的北京绿天使蔬果农业科研集团，2000 年 6 月改制成北京绿天使科技有限公司。由于公司雄厚的研发实力，迅速崛起成为以生物科技为主的高新技术企业。

本公司以生物科技产品为主导，生态农业、生态重建和荒漠治理为重点。公司具有自主进出口权和广泛的国际合作与创汇能力。公司拥有极具开拓精神勇于创新的科技力量，并且有目标地连续不断研发市场需求的高科技产品。坚持实践第一的科学准则，反复试验并获得大量数据和能谱是公司在近十年的历程里在激烈竞争中得以生存下来并发展壮大的根本原因。

本司以“推动农业商业化，科学种植，树立中国农业品牌”为宗旨，弘扬勤奋、高效、创新的企业精神，打造中国农副产品绿色、环保、无公害食品，致力于生产、改进及推广 BGA 土壤调理剂为代表的新型农业生产资料，以解决国家重大农业问题，积极从事与维护国家耕地安全、粮食安全、食品安全、环境安全有关的科研和应用项目。

本公司现阶段的主导产品——BGA 土壤调理剂已通过以三位院士为首的科学技术成果鉴定委员会的鉴定，并已获得国家农业部产品登记。用 BGA 土壤调理剂种植的蔬菜相继通过国家权威部门的“食用农产品安全认证”和“无公害农产品认证”。

本公司是北京市新技术产业开发试验区高新技术企业协会会员单位，北京市出口农产品创汇龙头企业，被国家和北京市认定为“高新技术企业”、“北京市星火科技先导型企业”、“国家重点星火项目及国家重点星火计划承担企业”和“承担北京市火炬计划项目单位”。

公司法人、董事长、总经理、技术发明人：张建民

注册地址：北京市海淀区中关村南大街 12 号培训中心 602 室　　邮　编：100081
办公地址：北京市海淀区皂君庙路 5 号卉园宾馆 602 室
电　　话：010－62120735　　传　真：010－62120734
科研和生产基地：北京市昌平区北七家镇政府街(定泗路)东
电　　话：010－69751471　　传　真：010－69756443

1 Introduction to BEIJING GREEN ANGEL TECHNOLOGY CO., LTD

北京市科学技术委员会组织的科学技术成果鉴定会 Scien-tech Achievement Appraisal Meeting organized by Beijing Municipal Science & Technology Commission BEIJING GREEN ANGEL TECHNOLOGY CO., LTD was established in June, 2000, derived from BEIJING GREEN ANGEL VEGETABLE AND FRUIT AGRO-TECH CO. GROUP which established in November, 1996. Because of the strong scientific research team, it became to be a high-tech enterprise mainly in biological field.

The company produces biological products for ecological agriculture, ecological reconstruction and desert control. It has the independent right for import and export, and the ability of widespread international cooperation and foreign exchange generation. The company has the spirit of creation and renovation in scientific research. It consistently develops high-tech products according to market demand. The maxim is practice first. Under the repeated experiments, numerous data and energy spectrum were obtained which is the basis for development and enlargement under strong market competition.

The company takes "to promote the commercialization of agriculture, agricultural science and technology grow, and establish agricultural brand in China" for the tenet, promotes the enterprise spirit of diligent, high efficiency and innovation to build the green, environmental protective and pollution-free food of China’ s agriculture. It dedicates to manufacturing, improving and the promoting the new agricultural production and material with the representative of BGA soil conditioner, so as to solve national critical agriculture problems. It actively engaged in the research and application projects related to safeguarding state cultivated land security, grain safety, food safety, environmental safety.

BGA soil activator, the current major product of the company has passed appraisal by the Science-Technology Achievement Appraisal Committee lead by 3 academicians, and obtained the product registration by the Ministry of Agriculture. The vegetables grew with BGA soil conditioner have passed the Food Agro-Product Save Accreditation and Non-pollution Agro-Product Accreditation one by one.

The company is a member of High-Tech Enterprise Association in Beijing New-Tech Enterprise Development Test Zone, and is a leading enterprise in Beijing Municipality for foreign exchange generation through exporting agricultural products. It was appointed to be the High-Tech Enterprise, the Pioneer Enterprise of Star and Fire Scientific Research of Beijing, the Undertaking Enterprise for National Star and Fire Scientific Research Project, and the Undertaking Enterprise for National Star and Fire Scientific Research Project of Beijing Municipality.

Legal person, Chairman of board, General Manager and Technology innovator: **Mr. Zhang Jianmin**

Address of registration: Room 602, Training Center, No. 12 Zhongguancun South Street, Haidian District, Beijing, 100081
Office address: Room 602, Huiyuan Hotel, No. 5, Zaojunmiao Road, Haidian district, Beijing
Telephone: 0086-10-62120735 Fax: 0086-10-62120734
Base of research and production: East end, Beiqijia village government road, Changping district, Beijing
Telephone: 0086-10-69751471 Fax: 0086-10-69756443

Certificate of New High-tech Enterprise

Authentication Certificate of New -tech Enterprise

Certificate of New High-tech Enterprise

Certificate of Project for Torch Program in Beijing

Certificate of honor

Certificate of honor

联合国生态地球联盟：全球生态与环境保护杰出成就奖

Advanced Enterprise of High Efficiency Agriculture in Beijing

Certificate of prize

National Star and Fire Key Project

Pioneer Demonstration Enterprise for Star and Fire Science-technology Program in Beijing

2 北京绿天使科技有限公司产品简介 Introduction to the Products

2.1 BGA 土壤调理剂 BGA Soil Conditioner

是公司现阶段主导产品。It's the company's leading product at present.

产品通用名：土壤调理剂 General Name of the Product: soil conditioner

商品名：BGA 土壤调理剂 Commercial Name: BGA soil conditioner

曾用商品名：BGA 土壤激活剂 Used Commercial Name: BGA soil activator

产品执行标准：Q/HD LTQ 001-2010Executive Standard of the product: Q/HD LTQ 001-2010

剂型和分类：粉剂——普通型、沙漠干旱型、高原贫瘠型、盐碱土壤型、酸性土壤型、病害作物专用型；即将生产颗粒型。

Form and type classification: Powder—common type, desert arid type, plateau infertile type, saline soil type, acid soil type, special type for plant disease; the granular type will be produced in the near future.

关键性成分：BGA 底料，是用本公司核心技术生产的，是 BGA 土壤调理剂具有优异性能的内在根本原因。

Key component: BGA base material produced by kernel technology. It is the internal reason for its good feature.

核心技术：张建民先生发明并命名的综合处理技术(英文简称 STT 技术)，营养及水分控制释放技术(英文简称 CRTNW 技术)，此两种技术为原创性高新技术。

Kernel technology: Synthetic Treatment Technology (STT) and Controlled- Release Technology of Nutrients and Water (CRTNW), which invented and named by Mr. Zhang Jianmin, the innovator, are the original creative high technology.

生产过程：发酵后或经膨化处理的农林有机废弃物，掺入 BGA 底料后即制得 BGA 土壤调理剂。

Production Process: Mix the inflated organic agricultural residues after fermentation with BGA base material to produce this BGA soil conditioner.

功能：改良土壤——荒漠治理、生态恢复、中低产田改造、盐碱地改良等；

Functions: Improve soil conditions-Desert governance, ecological restoration, transformation of medium and low-yielding land, saline-alkali soil improvement, etc.

营养植物——提高农林作物产量、改善农产品品质、防治某些作物难治病害、提高作物抗逆性、提高植树成活率、加速生态林和经济林建设等；

Supply nutrition to plant-Increase crop yield, improve the quality of agricultural products, refractory disease prevention and control of certain crops, improving crop resistance, improve the survival rate of tree planting to speed up the construction of ecological forest and economic forest, etc.

保水抗旱——抗旱、节水农业等

Water retention and drought resisting-Drought resisting, water-saving agriculture, etc

应用领域：防沙治沙、土壤改良、生态恢复、城乡绿化和园林建设、节水农业、经济林建设、公路和铁路路域绿化、城乡有机废弃物无害化和资源化处理等。

Application field: desert control, soil amelioration, ecological recovery, urban and rural forestation and garden construction, water-saving agriculture, cash forest construction, highway and railway territory afforestation, urban and rural organic waste harmless and resource-becoming disposal, etc.

特点：(1)以城乡有机废弃物(秸秆、锯末、枯枝、落叶、玉米芯等)为主要原料，变废为宝，化害为利。

Features: (1) The major raw materials are urban and rural waste such as plant residues, sawdust, dropped branch and leaf and corncob.

(2) 无毒，不含或极少含重金属等有害物质，是生产绿色食品理想的生产资料，生产、贮存、运输、使用中不产生污染，是完全环保型的产品。

(2) It is harmless, rare even no heavy metals, being a realistic agricultural means of production for growing green food. It does not release pollutants during manufacture, storage transportation and application.

（3）减少化肥和化学农药用量。

（3）Reduce the usage of fertilizer and chemical pesticide.

（4）能在其它产品无法种植的极端逆境条件下(干旱、严寒、高原、强紫外线、贫瘠、盐碱、重污染、低光照等)使农林作物正常生长,大幅度提高植树成活率和农产品产量。

（4）It is able to increase plant normal growing, thus the surviving rate of trees and yield of crops in extremely adverse conditions such as drought, cold, plateau, strong ultraviolet, barren soils, saline soils, heavy pollution and low sunshine.

（5）改善农林产品品质,恢复农林产品的天然风味。

（5）It is able to improve palate of the agricultural products, restoring their natural taste.

（6）节约用水。

（6）Save water.

（7）生态效益、经济效益、社会效益显著。

（7）Its efficiency is significant on ecology, economy and social aspects.

意义：对维护国家耕地安全、粮食安全、食品安全、环境安全以及增加农民收入、提高人民生活质量有重要意义。

Significance：It is of far reaching importance to safeguarding the state cultivated land security, grain safety, food safety, environmental safety, as well as increasing farmer’ s income, improving the quality of people’s life.

检测：普通项目用常规分析方法检测,BGA 底料用土壤能量信息谱仪检测。

Detection：Routine analyses test common items, soil energy signal spectrometer test BGA base material.

作用原理：植物正常生长的必须条件是土、水、肥、气、热、光等各种条件都同时得到满足。BGA 土壤调理剂能协调水分和营养的关系,它能够为植物特别是逆境中的植物提供一个完善的、和谐的根际小环境。

Mechanism of function：The necessary condition for the plant normal growth is soil, water, fertilizer, gas, heat, light, etc., which must be satisfied at the same time. BGA soil conditioner can coordinate the relationship between water and nutrition, so it can provide a small, thorough and harmonious environment at the rhizosphere for the plant, especially plant under adverse circumstances.

作用机理：（1）BGA 土壤调理剂的作用机理与“BGA 土壤调理剂—环境(土壤、气候、大气、光照…)—植物”这一体系中能量的吸收、贮存、转移和转化有关；

（1）Mechanism of function: The BGA soil conditioner related on the energy absorption, storage, transmission and transformation in the system of BGA soil conditioner—environment—plant.

（2）土壤是有能谱的,BGA 土壤调理剂施入土壤后能调整土壤能谱(激活)使之适合植物生长；

（2）Soil has energy spectrum. The BGA soil conditioner is able to regulate the energy spectrum to coincide with plant growth.

（3）植物正常生长不但需要养分在数量上的满足，同时还需要在能谱上的“和谐”。否则再高的养分对植物生长不但无益,反而有害；

（3）Normal growth of plant needs not only enough nutrients, but also their harmonious energy spectrum. Otherwise, nutrients may be harmful.

（4）BGA 土壤调理剂施入土壤后的絮凝作用引发出它的主要功能,大大缩短了自然界的成土进程,所以 BGA 土壤调理剂的作用机理可以高度概括为：以能量换时间。

（4）The flocculation of BGA soil conditioner after putting into soil shortens the natural soil-forming process, which means exchange energy with time.

社会认可及权威评价 Social recognition and authority evaluation：

（1）科技成果鉴定：以中国工程院刘更另院士、中国科学院阳含熙院士和蒋有绪院士为首的科学技术成果鉴定委员会认为：“BGA 土壤激活剂在激活和维持养分的改良土壤功能和价格低廉上处于国际国内同等产品的领先地位”；

（1）Evaluation of the Scientific and Technological Achievements: The Science-tech Achievement Appraisal Committee lead by Mr. Liu Gengling, an academician of Chinese Academy of

Engineering, Mr. Yang Hanxi and Mr. Jiang Youxu, academicians of Chinese Academy of Science indicated that the function of activating and keeping soil nutrients and soil amelioration by BGA soil conditioner as well as its cheap price showed its advanced position compared with similar products home and abroad.

（2）项目验收：以中国科学院刘光鼎院士为首的项目验收委员会认为："BGA 激活剂是一种突破了传统理论界限，原创型的新型农林生产资料"；

（2）Project Check and Accept: The Check & Accept Committee lead by Mr. Liu Guangding, an academician of Chinese Academy of Science indicated that BGA soil conditioner was a newly creative agricultural means of production. It broke-through traditional theory limit.

（3）国家产品登记：BGA 土壤调理剂已获得国家农业部产品登记：农肥(2004)临字 1574 号；

（3）National Product Registration: BGA soil conditioner has obtained the product registration by the Ministry of Agriculture: Agriculture Fertilizer (2004)Current No. 1574.

（4）用它种植的蔬菜相继通过国家权威部门的"食用农产品安全认证"和"无公害农产品认证"。

（4）The vegetables grew with BGA soil conditioner have passed the Food Agro-product Save Accreditation and Non-pollution Agro-product Accreditation one by one.

北京市科学技术委员会组织的科学技术成果鉴定会

Scien-tech Achievement Appraisal Meeting organized by Beijing Municipal Science & Technology Commission

主　任：刘更另院士(正面，中)
副主任：阳含熙院士(正面，右)
副主任：蒋有绪院士(正面，左)

Chairman Academician Mr. Liu Gengling (front，center)
Vice Chairman Academician
Mr. Yang Hanxi(front，right)
Vice Chairman Academician Mr. Jiang Youxu (front，left)

科 学 技 术 成 果 鉴 定 证 书

成 果 名 称：GA 激活剂及其应用

完 成 单 位：北京联大绿科技有限公司

鉴 定 形 式：会议鉴定

组织鉴定单位：北京市科学技术委员会

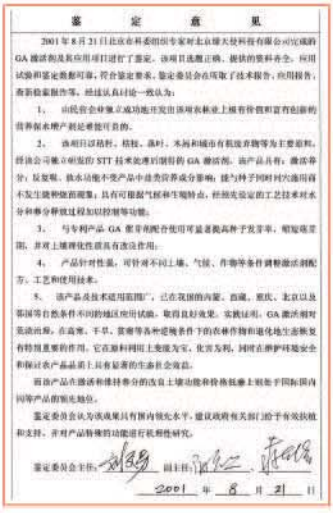
鉴 定 日 期：2001 年 8 月 21 日

鉴定批准日期：

国家科学技术委员会

一九九四年制

Certificate of Appraisal



鉴　定　意　见

2001 年 8 月 21 日北京市科委组织专家对北京联大绿科技有限公司完成的 GA 激活剂及其应用项目进行了鉴定。该项目选题正确，提供的资料齐全。应用试验和鉴定数据可靠，符合鉴定要求。鉴定委员会在听取了技术报告，应用报告，查新检索报告等，经过认真讨论一致认为：

1、 由民营企业独立成功地开发出该项农林业上颇有价值和富有创新的世界级水增产剂是可喜的。

2、 该项目适用于：棉花、蔬菜、水稻和城市有机废弃物等为主要原料，经该公司独立研发的 STT 技术处理后制得的 GA 激活剂。该产品具有：激活养分，反复吸、肥水功能不受产品中营养成分影响；能与种子同时同穴施用而不发生烧种烧苗现象；具有可根据气候和生境特点，经预先验证的工艺技术对水分和养分释放过程加以控制等功能。

3、 与专利产品 GA 螯合有机复合使用可显著提高种子发芽率，缩短成苗期，并对土壤理化性质具有改良作用。

4、 产品针对性强，可针对不同土壤、气候、作物等条件调整激活剂配方、工艺和使用技术。

5、 该产品及技术适用范围广，已在我国的内蒙、西藏、重庆、北京以及邻国等自然条件不同的地区应用试验，取得良好效果。实践证明，GA 激活剂对荒漠治理，在高寒、干旱、贫瘠等各种逆境条件下的农林作物和退化地生态恢复有特殊重要的作用。它在资料利用上变废为宝，化害为利，同时在维护环境安全和保证农产品品质上具有显著的生态社会效益。

该产品在激活和维持养分的改良土壤功能和价格低廉上明显于国际国内同等产品的领先地位。

鉴定委员会认为该成果具有国内领先水平，建议政府有关部门给予有效扶植和支持，并对产品特殊的功能进行机理性研究。

鉴定委员会主任：刘更另　副主任：阳含熙　蒋有绪

2001 年 8 月 21 日

View of Appraisal

2.2 BGA 叶面肥 BGA Foliar Fertilizer

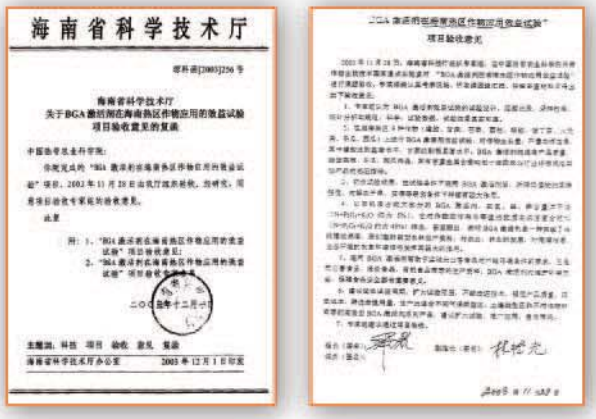
产品通用名：含氨基酸水溶肥料
General Name：Water-soluble fertilizer containing amino acid.
商品名：BGA 叶面肥
Commercial Name：BGA foliar fertilizer.
产品执行标准：NY 1429-2007Executive Standard of the product: NY 1429-2007
国家产品登记：BGA 叶面肥已获得国家农业部产品正式登记证：农肥准字 1606 号。
National Product Registration：BGA foliar fertilizer has gained the formal registration license from State Ministry of Agriculture: Agriculture Fertilizer Authorization No. 1606

海南省科学技术厅组织的项目验收会

Project Check & Accept Meeting Organized by Science and Technology Department of Hainan Province

刘光鼎院士(左)在主持项目验收会

Academician Liu Guangding (left) is holding the project check and acceptance meeting



中华人民共和国肥料登记证

Certificate of Fertilizer Registration of PRC

国家农业部正式登记证

Certificate of Fertilizer Registration of China

企业标准(北京市海淀区质技监局备案)

Enterprise Standard (reported to the record in Quality and Technology Supervision Bureau of Haidian District)

查新报告

Report of new Technology Survey

食用农产品安全认证、无公害农产品及产地认证

Certificate of safe edible agro-product and certificate of harmless agro-product

国内外权威部门的部分检测报告 Test reports home and abroad

3 BGA土壤调理剂的应用 The Application of BGA Soil Conditioner

3.1 改良土壤，扩大耕地面积，改善耕地质量 Soil Improvement, expanding cultivated land, and improving the quality of cultivated land

国家耕地安全和粮食安全是关系中华民族生死存亡的头等大事。我国现有耕地 18.26 亿亩，因道路、城市化建设每年还要减少耕地 400 多万亩，耕地形势异常严峻。BGA 土壤调理剂能将沙漠改造为良田，在盐碱地、干热河谷进行农业种植，复垦废弃矿山以增加耕地面积。如果利用 BGA 土壤调理剂将中国沙漠、戈壁、风蚀地和沙漠化土地的 1% 改造为良田，治理滇、黔、桂三省区 1% 的石漠化土地，治理 1% 的盐碱地，就会新增耕地 1487 万亩；农业利用云南的干热河谷地带的宜林荒山的 10%，累计可增耕地 3989 万亩；我国耕地中的 70% 是中低产田，滥施化肥使耕地质量严重下降，BGA 土壤调理剂能快速培肥地力，如将 10% 的中低产田改造成高产田使其单产提高 10%，相当于新增耕地 1300 万亩，从而为解决我国的耕地安全和粮食安全做出贡献。

The security of state cultivated land and the grain safety are the top issues related to the survival or extinction of the Chinese Nation. Now our country has cultivated land 0.1217 billion ha, but because of the road and city construction, this number will be decreased by 266.7 thousand ha, so the situation for cultivated land is very severe. BGA soil conditioner can transform desert to be fertile farmland, we can plant in saline-alkali soil and dry heat river valley, we can re-cultivate abandoned mine to increase cultivated land area. If BGA soil conditioner is used to transform 1% of the desert, gobi, land of deflation and desertification land to be fertile land, to transform 1% of the stony desert of Yunnan,Guizhou and Guangxi Provinces to be fertile land, to transform 1% of the saline-alkali soil, then the cultivated land will increase 991.33 square meters. If 10% afforestable barren hill of the dry heat river valley in Yunnan is used, then the cultivated land will increase 2659 thousand ha in all. 70% of our state cultivated land is middle-low yield farmland, indiscriminate use of fertilizer decreased the quality of cultivated lands fiercely, but BGA soil conditioner can rapidly fertilize the land capability. If 10% of the middle-low yield farmland is transformed to be high yield farmland and increase its yield per unit by 10%, then it equals to increase the cultivated land 8667 thousand ha million square meters. All the above will contribute much to solve the cultivated security and grain safety of our country.

3.1.1 BGA 土壤调理剂变沙漠为沃土 BGA soil conditioner can transform desert to be fertile soil

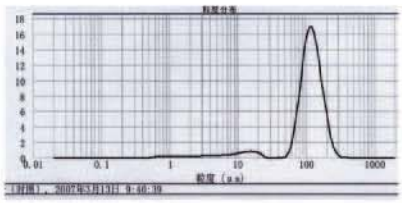
2000 年 11 月北京林业大学资源与环境学院在内蒙和林格尔县沙漠用 BGA 土壤调理剂做了种植油松和山杏种植试验。在 2001 年遭受 50 年未遇的严重干旱，全年降水量不足 150mm，上半年仅为 50 mm 并且没有人工浇灌的情况下未裸根的油松和山杏的成活率分别达到 81.8% 和 38.5%，没用 BGA 土壤调理剂的对照树的成活率均为 0。

2007 年 2 月现场调查发现使用 BGA 土壤调理剂的沙子都变成了大土块，经中国农业科学院土壤肥料研究所等权威单位测试表明，沙土在使用 BGA 土壤调理剂前后的外观、化学性质、团聚体组成、土壤质地、物理性质、微生物性质、能谱等方面都有显著的改变，土壤质地分析结果确切说明沙子已变成了沙质壤土，从而将数万年的自然成土过程缩短到几年。国内外的防沙治沙技术都是以水为中心，以恢复植被为目标，唯有 BGA 土壤调理剂才能在很短时间内最根本地将沙子改造成沃土，从而为恢复生态奠定最坚实的基础。

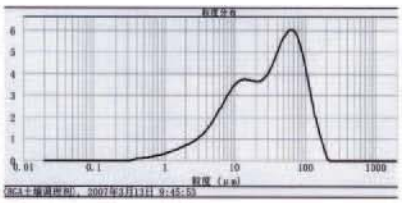
In November 2000, Resource and Environment Institute of Beijing Forestry University planted Chinese pine and Siberian Apricot for test with BGA soil conditioner in the Desert in Horinger County and Inner Mongolia Autonomous Region, where suffered from severe drought of 50 years-met in 2001, the annual amount of precipitation is less than 150mm, the first half year is only 50mm and without irrigate artificially, the survival rate of non-bare-boot Chinese pine and Siberian Apricot is 81.8% and 38.5%, while without BGA, the survival rate is 0. In February 2007, with the field survey, we found that the sand with BGA all transformed to be large soil block, and with the test of many authorities, such as the Soil and Fertilizer Institute CAAS, it showed that the appearance, chemical property, aggregate structure, soil texture, physical property, microorganism character and energy spectrum, etc. of the sand before and after using BGA soil conditioner changed obviously. The analysis result of the soil character showed exactly that the sand had transformed to be sandy-loam, which shortened the process of soil forming from ten of thousands years to several years.

The technologies domestic and oversea to prevent and control desertification are all water-centered, aimed to recover the plants, only BGA soil conditioner can transform sand to be fertile soil within a quite short time radically, thus can establish the most solid foundation for recovering the ecology.

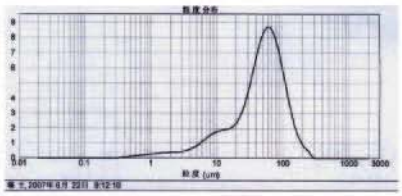
和林格尔用 *BGA* 土壤调理剂种植的山杏的根部沙子颜色变成了红棕色并结成大块
The sand on Horinger Desert planted apricot with BGA exchanges into reddish brown and forms the bulk



未施 *BGA* 土壤调理剂沙子的粒径分布
The particle size distribution of sandy soil without BGA soil conditioner



施过 *BGA* 土壤调理剂的沙子，实际上已变成了沙质壤土的粒径分布
The particle size distribution of sandy soil with BGA soil conditioner treatment (in fact, sandy loam)



取自廊坊的天然沙质壤土的粒径分布
The particle size distribution of nature sandy loam from Langfang City

样　品 Sample	粘粒 Clay <0.002 mm	粉粒 Silt 0.02～0.002 mm	沙粒 Sand 2～0.02 mm	土壤质地 Soil texture
施BGA前 Before BGA used	1.19	6.90	91.91	沙土 Sandy soil
施BGA后 After BGA used	3.68	38.34	57.96	沙质壤土 Sandy loam
天然沙质壤土 nature sandy loam	2.68	19.56	77.76	沙质壤土 Sandy loam

土壤化学性质的改变 The change of soil chemical properties

和林格尔沙漠 Horinger Desert　　测定日期 Data of analysis：2007−03−22

测定项目 Test items	水分 Water content	pH	有机质 Organic matter	阳离子交换量 CEC	全氮(N) Total-N	水解性氮(N) hydrolyzable-N	全磷(P) Total-P	有效磷(P) available-P	全钾(K) Total-K	速效钾(K) available-K
单位Unit	%		%	cmol/kg	%	g/kg	%	mg/kg	%	mg/kg
施BGA后 After BGA used	11.1	8.1	0.997	15.2	0.067	105	0.041	13.7	2.02	120
施BGA前 Before BGA used	0.9	8.2	0.132	2.8	0.007	5.51	0.019	15.4	1.92	69.6
后/前 After/before	12.3	/	7.6	5.4	9.6	19.1	2.2	0.9	1.1	1.7

测定项目 Test items	水分 Water content	交换性钙(Ca) Exchangeable-Ca	交换性镁(Mg) Exch.-Mg	有效硫(S) available-S	有效铜(Cu) available-Cu	有效铁(Fe) available-Fe	有效锰(Mn) available-Mn	有效锌(Zn) available-Zn	有效硼(B) available-B
单位Unit	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
施BGA后 After BGA used	2.5	0.375	274	55.8	1.04	15.2	9.80	2.87	0.91
施BGA前 Before BGA used	0.6	0.251	12.5	69.7	0.36	4.92	2.91	2.46	0.84
后/前 After/before	4.2	1.5	21.9	0.8	2.9	3.1	3.4	1.2	1.1

土壤物理性质的改变 Changes of soil physical properties

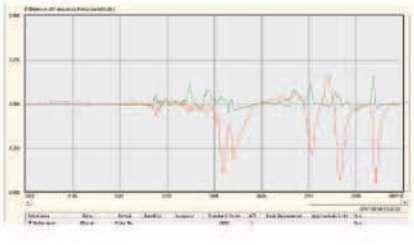
项目 Item	比表面积 Specific surface area	体积平均粒径 Volume mean particle diameter
单位 Unit	m^2/g	μm
BGA土壤调理剂 BGA	0.563	43.178
对照 CK	0.171	118.762

土壤微生物性质的改变 Changes of microbiologic properties

项目 Item	细菌总数 Amountof bacterium	放线菌总数 Amountof actinomyces
单位 Unit	cfu/g	cfu/g
BGA土壤调理剂 BGA	1.1×10^6	2.0×10^6
对照CK	2.1×10^7	3.9×10^4

土壤能谱的改变 Chang of soil energy spectrum

施用 *BGA* 调理剂后的沙土（实际上已被改良为沙质壤土）的能谱（红线）与作为参沙质壤土的能谱（绿线）基本一致
The energy spectrum of sandy soil with BGA (red line) is vary similar to the energy spectrum of natural sandy loam



未施用 *BGA* 调理剂的原沙土的能谱（红线）与作为参比的天然沙质壤土的能谱（绿线）很不一致
The energy spectrum of sandy soil without BGA (red line) is vary different to the energy spectrum of natural sandy loam(green line)

3.1.2 BGA 土壤调理剂改造中低产田 BGA soil conditioner used to transform medium and low-yielding land

2001 年 5 月在重庆市万州区?渡镇贫瘠的紫色土做了 BGA 土壤调理剂试验,尽管遭遇了 104 天不下雨的大旱,用 BGA 土壤调理剂的农作物仍然获得丰收,并快速地改良土壤:由原先的五、六级土变为三、四级或一、二级土,到 2010 年 7 月再取样时还维持着变化。

In May 2001, a BGA soil conditioner test was made for the barren purple soil in Rangdu Town, Wanzhou District of Chongqing. Although it suffered from a big drought of rainless 104 days,but the crops with BGA soil conditioner was harvest as normal and rapidly trans formed the soil.The soil turned from the former 5 to 6 grade soil to be 3 to 4 grade or 1 to 2 grade soil, and it continued the change till sampled in July 2010.

without fertilizer and BGA *with chemical fertilizer* *with BGA soil conditioner*

重庆市万州区长江三峡工程库区 Increasing soil available nutrients (Wanzhou District, Chongqing)

作物 Crops		黄瓜 Cucumber						西红柿 Tomato						生菜 Lettuce					
测试项目 Test items		碱解氮 hydrolyzable-N		有效磷 available-P		速效钾 available-K		碱解氮 h.-N		有效磷 a.-P		速效钾 a.-K		碱解氮 h.-N		有效磷 a.-P		速效钾 a.-K	
		含量 content	级 grad	含量 c.	级 g.	含量 c.	级 g.	含量 c.	级 g.	含量 c.	级 g.	含量 c.	级 g.	含量 c.	级 g.	含量 c.	级 g.	含量 c.	级 g.
施用前, mg/kg Before BGA used		28	6	7.20	4	69.9	4	21	6	4.13	5	61.1	4	55	5	5.28	5	34.3	5
施用且收获后 After harvest withBGA used, mg/kg		163.5	1	85.7	1	123	3	90.8	3	75.3	1	88.2	4	151.6	1	81.4	1	103	3
收获后净余 Net surplus after harvest	kg/亩	57.6		30.2		26.9		40.0		31.8		18.9		53.4		30.6		22.0	
	kg/ha	864		453		404		600		477		284		801		459		330	

3.1.3 盐碱地、干热河谷的利用 Growing on saline soil

新疆克拉玛依,pH 9.0 左右的盐碱地成功地种植了小麦、白兰瓜、西红柿等作物,陕西大荔种棉花等。

Kelamayi, Xinjiang. Wheat, muskmelon tomato successfully grew on saline soil with pH 9.0

克拉玛依盐碱地种小麦远处用 *BGA* 土壤调理剂近处用化肥

Wheat: near was with chemical fertilizers, background was with BGA soil conditioner

陕西大荔盐碱地种棉花右边用 *BGA* 土壤调理剂,较左边用化肥产棉多 *50%*

According to estimation by cotton grower, cotton treated by BGA soil conditioner at right got 50% more yield than that treated by chemical fertilizers at left

3.1.4 云南干热河谷地带的种植 Planting in Arid Hot Valley Area in Yunnan

金沙江干热河谷典型区元谋段自然环境条件恶劣、植被退化与破坏严重、不良耕作与过度放牧、生态安全意识薄弱、生产力低下和经济落后。用 BGA 土壤调理剂进行种植在获得丰收的同时还从根本上解决问题——改良土壤。

In Yuanmou, the typical area of Jinshajiang Arid Hot Valley Land, the natural environment is severe, the vegetation was heavily destructed and degraded, improper cultivation and overgrazing as well as poor sense of ecological security made the productivity low and backward in economy.Planting with BGA Soil Conditioner not only produces good harvest but also solve the problem -- soil improvement thoroughly

用化肥种植的西红柿

Tomatoes Planted with Chemical Fertilizer

用 *BGA* 土壤调理剂种植的西红柿

Tomatoes Planted with BGA soil conditioner

3.2 提高产量,促进农业丰收 Improve the yield amount, promote harvest

自本公司 1996 年组建的 14 年来，BGA 土壤调理剂已经在除澳门外的所有省、直辖市、自治区(包括台湾)做过试验,反馈回信息的基本上全都增产。

Since the 14 years of the company' s establishment in 1996, BGA soil conditioner had done tests in all provinces, municipalities and autonomous regions (including Taiwan) except for Macao, and all the information feedback is production increasing.

3.2.1 良好条件下水稻高产攻关项目，高产再高产 The yield of rice yield research project under good conditions, higher and higher yield

辽宁省海城市是我国北方重要的水稻产区之一，土壤、气候等条件比较优越，中国工程院院士、沈阳农大陈温福教授培育的“千重浪”稻种用常规化肥产量已达 682 公斤／亩。2007 年海城市科技局与本公司合作，在海城市西四镇下坎部队农场开始了“水稻高产预攻关项目试验”，试验由具有 40 多年水稻种植经验的鞍山市特等劳动模范刘洪生先生具体执行，用 BGA 土壤调理剂和 BGA 叶面肥种植的“千重浪”水稻亩产达 780 公斤，增产 14.4%，水稻生长过程中完全没用农药，米质更好，取得非常好的效果。

2009 年在北京长安公证处公证下本公司科研基地用 BGA 土壤调理剂和 BGA 叶面肥种植的同样稻种产量达 925.6 公斤／亩。

Haicheng, a city in Liaoning province, is one of the important rice production areas in the north of China, with a comparative superior soil, climate, etc. The seed rice called “Qianchong Wave” cultivated by Chen Wenfu, academician of CAE, and professor in Shenyang Agriculture University, whose yield amount was over 10.23t/ha with regular fertilizer. In 2007, Haicheng Science and Technology Bureau cooperated with our company and started the “Rice high-yield pre-critical project test” at Xiakan Army Farm in Xisi Town, Haicheng. The test was carried out by Mr. Liu Hongsheng, Top grade model worker in Anshan, who has over 40 years' experience in planting rice. BGA soil conditioner and BGA foliar fertilizer were used to plant “Qianchong Wave” rice, and its yield amount became 11.7t/ha, whose production increased 14.4%. And there's no pesticide at all, so the rice quality was batter, and finally it gained very good result.

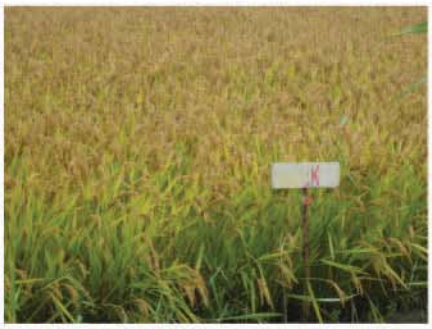
In 2009, under the notarization of Beijing Chang' an notary office, the yield amount of the same kind of rice achieved 13.88t/ha with our BGA soil conditioner and BGA foliar fertilizer in our company's science facility.

海城水稻比较表
Comparison Sheet of Rice in Haicheng

处理 treatment	符号 Sign	株高 Plant Height/cm	穗长 Ear Length/cm	穴/亩 Spot/mu	穗/穴 Ear/spot	万穗/亩 Tens of thousands ears/mu	结实率(%) Yield rate	千粒重/g Weight of thousandgrains	每穗粒数/个 Numbers per ear			实收 yield in fact		
									实粒 Grains available	空粒 Vain grains	总粒 Total grains	总面积/亩 Total area/mu	总产量/kg Total yield	亩产/(kg/亩) Yield per mu kg/mu
常规施肥 Regular fertilizing	CK	97	13.5	15330	17	22.7	91.6	24	137	11	148	1.5	1023	682
BGA 土壤调理剂加 BGA 叶面肥 BGA soil conditioner plus BGA foliar fertilizer	B	101	15.9	13260	17.3	22.9	91	22.6	160	14	174	1.5	1170	780
(B－CK)／CK,%	/	4.1	17.8	－0.67	1.8	0.88	－0.66	－5.8	16.8	27.3	17.6	0	14.4	14.4

Note:1mu=1/15 h

海城施 *BGA* 土壤调理剂的水稻
Rice with BGA soil conditioner in Haicheng



海城常规施肥的水稻 *Rice with conventional fertilization in Haicheng*

左：*BGA* 土壤调理剂；右：化肥
Left: BGA soil conditioner
Right: chemical fertilizer

本公司基地 *2005* 年种的水稻，亩产 *800* 公斤左右
The output of the rice planted in 2005 was about 12t/ha for the planting base of the company

本公司基地 *2009* 年水稻收割现场，亩产 *925.6* 公斤，右三、右四为公证员
The rice harvesting in 2009 for the planting base of the company, with the output of 13.884/ha. The third and the fourth from right

本公司基地 *2010* 年种的水稻，也将丰收
The output of the rice planted in 2010 will get good harvest

3.2.2 改良土壤，逆境条件下提高单位面积产量 Increasing per nuit area yield , especially in adverse conditions

(1)重庆市万州区长江三峡工程库区，试验地在无灌溉条件的山顶，贫瘠的紫色土，104 天不降雨。
Wanzhou District, Chongqiong in Three Gorges Reservoir Zone. The trial field located on top of the mountain without irrigation. Poor purplish soil. 104 days without rainfall.

农作物 Crops			黄瓜 Cucumber	西红柿 Tomato	西瓜 Water melon
产量 Yield	kg/亩	BGA	2637	7336	4653
		CK	73	2018	1225
	t/ha	BGA	39.56	110.04	69.80
		CK	1.10	30.27	18.38

用 *BGA* 的黄瓜
Cucum-ber treated with BGA

不用 *BGA* 的黄瓜
Cucum-ber without BGA

(2)西藏堆龙德庆县海拔 4000 米，年均降水 440 毫米，无霜期 120 天。
Duilongdeqing County, Tibet is 4000 m above sea level. The annual precipitation is 440 mm, 120 frostless days.

农作物 Crops			黄瓜 Cucumber	西红柿 Tomato	西瓜 Water melon	苦瓜 Balsam pear
产量 Yield	kg/亩	BGA	5061	4106	4290	7587
		CK	3489	1167	2507	2963
	t/ha	BGA	75.92	61.59	64.35	113.80
		CK	52.34	17.50	37.60	44.44

BGA 使西藏鲜花怒放
The flowers with BGA are in full bloom in Tibet

(3)本公司昌平科研基地　　Changping Scientific Research Base of our company

葡萄：左化肥种均粗 *3.44cm*, 亩产 *800kg*，右为 *BGA* 土壤调理剂剂种均粗 *4.80 cm* 亩产 *2000kg*。
Grape: on the left was treated with chemical fertilizers, average stem diameter was 3.44cm, yielding 12t/ha. On the right was treated with BGA soil conditioner, average stem diameter was 4.80cm,yielding 30t/ha

BGA 土壤调理剂在一个花盆中种的一株丝瓜结瓜 *26* 个
A plant of vegetablesponge grew in a pot treated with BGA soil conditioner bore 26 fruits

BGA 土壤调理剂在一个花盆中种的一株葫芦结葫芦 *96* 个
A plant of bottle gourd grew in a pot treated with BGA soil conditioner bore 96 gourds

(4)河南灵宝市　　Lingbao, Henan Province

2008 年农民使用 BGA 土壤调理剂种植的大枣及葡萄大获丰收，在产量对比中发现，使用 BGA 种植的大枣及葡萄相对其他化肥种植的增产将近 30%。

In 2008, farmers who used BGA soil conditioner, harvested the dates and grapes, and in the yield amount comparation we found that the yield amount was increase nearly 30% with BGA.

(5)海南省东方市　　Dongfang, Hainan Province

2008 年农民使用 BGA 土壤调理剂种植的大枣及葡萄大获丰收，在产量对比中发现，使用 BGA 种植的大枣及葡萄相对其他化肥种植的增产将近 30%。

In 2008, farmers who used BGA soil conditioner, harvested the dates and grapes, and in the yield amount comparation we found that the yield amount was increase nearly 30% with BGA.

不用 *BGA* 土壤调理剂种植的香蕉果实较短
Without BGA soil conditoner, the banana is shorter.

使用 *BGA* 土壤调理剂种植的香蕉果实较长
With BGA soil conditioner, the banana is longer

不用 *BGA* 土壤调理剂种植的甘蔗苗株瘦弱
Without BGA soil conditioner, the sugarcane plant is thin and weak

使用 *BGA* 土壤调理剂种植的甘蔗苗株粗壮
With BGA soil conditioner, the sugarcane plant is thick and strong

3.3 减肥增效，有助于维护国家环境安全
Decrease chemical fertilizer and increase benefit, contribute to safeguarding the security of state environment

化肥为解决人类的温饱起了巨大作用，但是滥施化肥造成的恶果正惩罚着人类自身。已故著名土壤肥料学家、中国农业科学院原副院长、中国工程院院士刘更另研究员指出我国化肥利用率长期偏低，氮肥为 30% ～ 35%(当季)，磷肥为 15% ～ 20%，钾肥不超过 65%，使中国占世界 7% 的耕地使用了世界 35% 的化肥。我国每年损失仅氮肥就高达 430 亿～ 500 亿元，现有复合肥中的磷施入土壤 35 ～ 40 天后有效性下降 80%，绝大部分被固定而失去效果。滥用化肥造成的土地板结、环境污染、生态破坏、农林产品品质严重下降、资源浪费等等恶果真是令人触目惊心，减肥增效已成为迫在眉睫的农业大事。本公司近几年，一直在进行减肥增效方面的尝试，无论是实践上还是理论上都取得了一定成果。2002 年海南的等量、等值的 BGA 土壤调理剂(氮磷钾含量约 5%)与挪威产高浓度复混肥(氮磷钾含量 45%)效益对比试验是 BGA 土壤调理剂减少化肥用量的典型例子。

Chemical fertilizer plays a big role in solving the problem of having enough to eat and wear for human, but the disastrous effect of fertilizer lavishement is punishing human themselves. Mr. Liu Gengling, late famous soil fertilizer scholar, primary Vice president of Chinese Academy of Agricultural Sciences, Academician of Chinese Academy of Engineering, pointed that in our country, the recovery of chemical fertilizer is very low in a long-term, recovery of nitrogen fertilizer is 30% ～ 35% (in the season), recovery of phosphatic fertilizer is 15% ～ 20%, while recovery of potash fertilizer is not more than 65%, which makes China who owns 7% cultivated land in the world uses 35% of chemical fertilizer. We will lose 43 to

50 billion yuan annually only for Nitrogen fertilizer. The availability of phosphorus put into the soil of the current compound fertilizer decreases 80% after 35 ～ 40 days, and most of it is fixed so as to lose effect. The disastrous effects cause by abuse of the fertilizer are shocking by the sight, such as land harden, environmental pollution and ecological destruction, quality of agriculture and forestry products seriously decline and the waste of resources, decreasing chemical fertilizer and increasing benefit has been to a extremely urgent agriculture affair.

In recent years, the company has been taking efforts to decrease chemical fertilizer and increase benefit, and have gained some achievements both in practical and theoretical. In 2002, the benefit comparative test between the equivalent amount and value Hainan BGA soil conditioner (the content of N, P2O5 and K2O was about 5%) and the high concentrated compound fertilizer made in Norway (the content of N, P2O5 and K2O was 45%) was the typical model to certify that BGA soil conditioner can reduce the usage of chemical fertilizer.

海南 BGA 土壤调理剂与等量高浓度复混肥对比试验产量结果

Benefit comparison BGA and high concentrated compound fertilizer *CF=chemical fertilizers*

农作物 Crops	甘蔗 Sugarcane	胡椒 Pepper	芒果 Mango	荔枝 Litchi	苦丁茶 Kudin cratoxylum	冬瓜 Chinese wax gourd	西瓜 Water melon
激活剂产量 kg/亩 BGA Yield kg/mu	7413.50	199.36	947.10	506.10	139.26	4590.00	3975.00
高浓度复混肥产量 kg/亩 CF Yield kg/mu	5349.70	189.28	884.10	493.92	126.72	4305.00	3600.00

就施肥与土壤健康质量而言，有机肥的问题比无机肥更严重。有机肥既有病原微生物和有机毒物，也有重金属污染的问题。目前我国畜禽养殖粪便年产生量约为 19.3 亿吨，所含污染物的化学需氧量为 7118 万吨，已超过全国工业废水与生活污水的化学需氧量，全国畜禽粪便氮、磷流失总量分别为化肥氮、磷流失总量的 1.2 倍和 1.3 倍，已成为农业面源污染的主要来源，畜禽养殖污染产生的环境问题日益突出。有机肥污染水体，污染空气，积累重金属。这是因为畜禽饲料的添加剂，畜（禽）用的多种药剂，包装及日用品（如电池等）的金属材料，垃圾和污泥中都含有较高的重金属。堆肥制造过程不仅脱水，而且酸度的变化会活化重金属。并且有机肥还能传染病原菌。

2005 年本公司委托中国农科院土肥所做的一系列小区和大田示范试验表明：施用 BGA 土壤调理剂比施用等养分有机肥全面增产。

For fertilizer usage and soil health quality, it is much more severe of organic fertilizer than inorganic one. The organic fertilizer has not only pathogenic microbes but also organic toxicants, and it has the problem of heavy metal pollution as well. At present, the annual production of the excrement from animal cultivation in our country is 1.93 billion tons, within them, the pollution chemical oxygen demand is about 71.18 million tons, which has exceeded the demands of industrial waste water and life sewage, the run off amount of N and P of the animal excrement is separately 1.2 times and 1.3 times of the industrial waste water and life sewage, and it has become the main reason source of agricultural area source pollution to agriculture, and the environmental problems cause by animal feeding pollution is more and more obvious. Organic fertilizer pollutes water and air, and accumulates heavy metal. It is because of the additive to the animal feeds, livestock (poultry)-use variety of pharmaceutical, packaging and commodities (such as batteries, etc.) of metal materials, waste and sludge contain high heavy metal. Compost manufacturing process is not only dehydration, but also changes in acidity of heavy metals will be activated, and organic fertilizer can spread pathogens.

In 2005, the company commissioned the Soil and Fertilizer Institute CAAS to do a series of small area and large zone test, and the results certified: using BGA soil conditioner will thoroughly increase the production compared to the organic fertilizers with the equivalent nutrition.

3.4 改善农产品品质，提高人民生活质量，农民增产增收 Improve the quality of agricultural products, people's life, and farmers' income

近年来瘦肉精、三聚氰胺、苏丹红等等危及国人生命和健康的严重事件屡屡发生，维护国家食品安全已刻不容缓，滥施化肥和农药使农产品品质严重下滑，应有风味丧失殆尽。BGA 土壤调理剂在一般条件下可以不用农药，极大地改善农产品品质，恢复农产品原有的天然风味。日本的食品标准向以严苛著称于世，日本权威单位分析表明，用 BGA 土壤调理剂种植的农产品，不含或极少含重金属，完全不含其它农产品常被检出的 204 种农药残留，品质远远优于日本的食品标准。

It is the time that the national food safety should be maintained as some serious issues occurred one after another, such as thin camosine, melamine, Sudanred, etc., which has been seriously dangerous for the people' s lives and health in recent years. The origin flavor was damaged and the quality of agricultural products was declined because of abuse the chemical fertilizers and pesticides. BGA soil conditioner controls no pesticides under a general condition, which greatly improve the quality of agricultural products and return the original flavor. Japanese food standard is world-known for its strictness and the BGA product' s quality is far superior to the standard. Japanese authority agencies analyze and indicate that the BGA product has less or even no heavy metal and no 204 oftenly detected pesticide residues.

3.4.1 上海马陆大棚葡萄

上海市嘉定区马陆葡萄主题公园 C-341 棚种植的?稔葡萄（售价为普通葡萄的 5 倍）。2007 年 4 月 30 日按 1kg/ 株 BGA 土壤调理剂追施，以常规施肥为对照，提早 5 ～ 7 天成熟，平均糖度由 13.86 度提高到 15.68 度，口感脆甜，果色红亮，产量提高 61.7%，在 31℃ ～ 35℃条件下存放 4 天无烂果，9 天后全烂；对照葡萄果色浅、发暗，口感软，相同条件下存放 4 天烂掉 1/4，6 天全部烂掉。

Variety: Tengren. Site: greenhouse No. 341, Malu Grape Subject Park. CK: conventional side dressing, famous variety of Malu grape (the price was 5 times higher than that of common variety). On April 30, 2007, the rate of side dressing is BGA 1kg/plt, compared with regular fertilizing, and it was ripe 5-7 days earlier, and the average sugar degree increased to 15.68 from 13.86 with good and sweet taste, red and bright color, and the yield increased by 61.7%. There' s no rotten fruit in the temperature of 31?-35? within 4 days storage, and after 9 days, all rotted. The compared grapes are with lighter and darker color, weaker taste, in the same condition of storage, and it rotted 1/4 within 4 days and all rotted after 6 days.

上海市嘉定区申区长 (右), 马陆镇农办周副主任 (左), 马陆葡萄主题公园宋场长在取样
Director Shen of Jiading District, Shanghai (right), Vice Director Zhou (left) of Agriculture Office, Malu Township, and Director Song of Malu Grape Subject Park were taking samples

课题总结会，左为嘉定区主管农业的副区长
Subject Summing-up Meeting. The left is the deputy district head responsible for agriculture in Jiading District

31℃～ 35℃存放 4 天后的葡萄：
(左)用 *BGA* 土壤调理剂
(右)常规施肥
Grape 4 days after picking preserved at 31℃-35℃.
Left: treated by BGA;
Right: conventional fertilizer application

3.4.2 河南灵宝苹果 Apple in Lingbao, Henan Province

用 BGA 土壤调理剂种植的苹果着色好，甜、脆，抗氧化，耐储存，价格高，易销售。

The apple treated by BGA has good color, sweet, crisp, anti-oxidation, stored longer time, pricing higher and sold easier.

左：常规施肥种植的苹果；
右：*BGA* 土壤调理剂种植的苹果
Apples left: conventional fertilization;
Right: BGA soil conditioner

同时咬开的苹果，左：常规施肥种植的苹果；
右：*BGA* 土壤调理剂种植的苹果
Apples bitten at the same time. Left: conventional fertilization;
Right: BGA soil conditioner

3.4.3 辽宁海城南果梨和西瓜 Nanguo pear and watermelon in Haicheng, Liaoning Province

南果梨是海城的特产，享誉中外。但是为高产滥施化肥，使其品质严重下降，销售价格下跌，果农苦不堪言。2009 年南果梨主产区之一马风镇祝家村试用 BGA 土壤调理剂，南果梨品质大幅度改善，原先的天然风味得以恢复，果农卖了高价还供不应求。海城市非常重视，专门召开项目论证会，建议全市大面积推广。马风镇党委书记介绍：2010 年海城西瓜丰收，普通西瓜 0.15 元 / 斤还卖不出去，用 BGA 土壤调理剂种的西瓜 0.50 元 / 斤很快脱销。

Nanguo pear is the specialty in Haicheng with the good reputation domestic and oversea. But the abuse usage of chemical fertilizer in order to get high production caused their quality decreasing seriously, sales price reduced rapidly and the farmers were miserable. In 2009, one of the main producing areas in of Nanguo pear Ma feng Town, ZhujiaVillage,make trial of BGA soil conditioner, a significant improvement in the quality of Nanguo pear, to restore the original natural flavor, farmers sell at high prices is also in short supply. Haicheng city attaches great importance to the project demonstration will be held specifically recommended that the city's large area. Mafeng Town Party Secretary description: Haicheng watermelon harvest in 2010, ordinary watermelon 0.30 yuan / kg also not sell, with BGA soil conditioner species watermelon 1.00yuan / kg quickly sold out.

祝家村漫山遍野的南果梨
The all over the mountains and plains Nanguo pear in Zhujia Village

海城市林业局主持召开的 *BGA* 土壤调理剂南果梨试验论证会
The test and discussing meeting about Nanguo pear with BGA soil conditioner hosted by Haicheng Forest bureau

3.4.4 检验报告 Examination Report

权威部门检测证实用 BGA 土壤调理剂种植的农林产品中重金属等有害物质含量极低，口感特好，恢复了蔬菜水果的天然口味，相继通过了食用农产品安全认证和无公害农产品认证。

Appropriate authority test has proven: the agriculture and forestry products treated with BGA soil conditioner has vary low bad materials such as heavy metals, taste perfect, and restore the nature taste of vegetables and fruits. These products passed the safe certification of edible agricultural products and pollution-free agricultural products. The vegetables' quality with BGA soil conditioner won the extensive recognition in Japan which was famous by its strict food criteria.

(1)国内的检验报告 Examination Report domestic

BGA 土壤调理剂和化肥种植的生菜营养物质含量比较

Comparison of BGA soil conditioner with chemical fertilizer on nutrients content in romaine lettuce

处理 Treatment	干物质 Dry matter	Vc	总糖 Total carbohydrate	钙(Ca)	铁(Fe)	锌(Zn)	钾(K)
	%	mg/100g	%	mg/kg	mg/kg	mg/kg	%
BGA土壤调理剂 BGA soil conditioner	5.94	10.6	1.43	491	11.0	1.70	0.196
化肥 Chemical fertilizer	5.05	9.30	0.84	402	10.8	1.63	0.162

BGA 土壤调理剂种植的黄瓜中物质含量

Nutrients content in cucumber with BGA soil conditioner

蔬菜 Vegetables	水分 Water	蛋白质 Protein	脂肪 Fat	总糖 Total carbohydrate	纤维 Fiber	灰分 Ash	钾 K	钙 Ca	锌 Zn	铁 Fe	维CVc
单位 Unit	%	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/100g
黄瓜 Cucumber	95.6	0.666	0.068	3.04	0.33	0.30	0.095	2580	1.73	2.19	11.61

BGA 土壤调理剂种植的蔬菜中有害物质含量

Content of harmful matter in vegetables with BGA soil conditioner *mg/kg*

蔬菜 Vegetables	砷 As	铅 Pb	汞 Hg	铬 Cr	镉 Cd	亚硝酸盐 Nitride	氟 F	敌敌畏 Dichlorvos	乐果 Dimethoate	倍硫磷 Fenthion	杀螟硫磷 Fenitrothion	六六六 666	滴滴涕 DDT
黄瓜 Cucumber	0.005	0.0334	0.0026	0.0025	0.0128	0.05	/	/	/	/	/	/	/
樱桃西红柿 Cherry tomato	0.000818	/	未检出 No found	/	未检出 No found	/	0.17	未检出 No found	未检出 No found	未检出 No found	未检出 No found	未检出 No found	未检出 No found
草莓 Strawberry	0.013	<0.1	0.0010	/	0.016	/	/	/	/	/	/	/	/

(2)日本的检验报告 Examination report from Japan

日本权威机构检验了用 BGA 土壤调理剂种植产自中国的苹果、大米、西红柿和产自日本的西红柿等，质量绝佳，在日本用 BGA 土壤调理剂种植的西红柿以 BGA 品牌，以每个 13 元人民币的价格在日本的大型超市的专门柜台出售，深受欢迎。

Japanese authorities tested the apple, rice and tomatoes planted with the BGA soil conditioner from China and tomato from Japan, and found that the taste was super-excellence. In Japan, tomato planted with BGA soil conditioner took BGA as the brand, and the price for each one is 13 RMB at major supermarket chains in Japan, a special counter sale, is most welcome.

日本超市中出售的 *BGA* 西红柿
BGA tomatoes on sale in the supermarket in Japan

BGA 西红柿的养分分析报告 *Nutrition analysis report of BGA tomato*

BGA 西红柿养分含量全都优于日本食品标准，见下表，单位为 μg/100g。

Nutrient content of BGA tomatoes are all above the Japanese food standard, as shown in the following table in μg/100g.

	番茄红素 Lycopene	β 胡萝卜素 β Carotene	维生素 A Vitamin A	总维生素C Vitamin C	糖度 Sugar degree	维生素 B1 Vitamin B1	维生素B2 Vitamin B2	维生素 B6 Vitamin B6	α 维生素E α Vitamin E	γ 维生素E γ Vitamin E
BGA 西红柿 BGA tomato	7.4	809	67	29	9.0	0.1	0.03	0.15	1.7	0.6
日本食品标准 Food Standard Japan	6.0	540	45	15	6.5	0.05	0.02	0.08	0.9	0.2

	维生素 c Vitamin C	β-胡萝卜素 β Carotene	细菌数 Bacterial	大肠菌群 Coliform	黄色葡萄球菌 Yellow staphylococcus	沙门氏菌 Salmonellin	霉菌 Mould	酵母数 Yeast
单 位 Unit	mg/100g	μg/100g	g	0.1g×2	0.1g×2	25g	0.01g×3	0.1g×3
哈密瓜（北京产） Hami melon (made in Beijing)	21	6	＜300	阴性 Negative	阴性 Negative	阴性 Negative	阴性 Negative	阴性 Negative
葡萄（北京产） Grape (made in Beijing)	3	23	1.2×10^1	阴性 Negative	阴性 Negative	阴性 Negative	阴性 Negative	1.0×10^1
西瓜 Watermelon	8	500	/	/	/	/	/	/

其它检验结果表明，完全没有致病菌和重金属污染，养分含量普遍提高：

Other inspections showed shat they don' t have pathogenic bacteria or heavy metal pollution, and the nutrient content is universally increased:

农作物 Crop	分析项目 Analysis item	铁 Fe	钙 Ca	镁 Mg	铜 Cu	锌 Zn	锰 Mn	蛋白质 protrin	脂肪 Fat	灰分 Ash	淀粉 Starch	食物纤维 Food Fibre	热量 Calorie	SOD	硝酸态氮 nitric nitrogen	砷 As	铅 Pb	铬 Cr	镉 Cd	汞 Hg
	单位 Unit	mg/100g						%					kcal/100g	单位 Unit/g	mg/kg					
BGA 大米 BGA rice	检测 Detection	15.4	7.7	41.9	0.49	1.89	0.60	7.5	1.6	0.6	75.6	0.9	349	230	0.13	未检出 NO	未检出 NO	未检出 NO	0.01	未检出 NO
	标准 Standard	2.1	9	110	0.27	1.8	2.0	6.8	2.7	1.2	73.8	0.7	350	/	0.5	/	/	/	0.4	/
BGA 苹果 BGA apple	检测 Detection	未检出 NO	6.6	4.1	0.04		0.02	0.27	糖度：13.7 Sugar			/	/	90	未检出 NO	未检出 NO	未检出 NO	未检出 NO	未检出 NO	未检出 NO
	标准 Standard	/	3	3	0.04	0	0.03	/	糖度：/ Sugar			/	/	/	/	/	/	/	/	/

注：(1)日本农林水产省熊本检测派出机构测定 BGA 大米的糙米出米率为 97.6%，整精米率为 77.0%。

(2) 2010 年 4 月中国农业科学院果树研究所王景彦研究员检测了比赛中获得“果王”称号的陕北洛川果农——冯农民先生用 BGA 土壤调理剂种植并已经储存了半年的苹果，其 SOD 含量仍高达 58.71 单位 /g。王景彦研究员指出，化肥种植的苹果 SOD 含量为 20 单位 /g，叶面喷施 SOD 酶制剂的苹果的SOD含量可达30单位/g，用BGA土壤调理剂种植的苹果SOD含量高达90单位/g(鲜果，日本检测)和 59 单位 /g(陈果，中国检测)简直就是奇迹。

Note: (1) The white rice yield from brown rice rate of BGA Rice is 97.6%, milled rice rate is 77%, reported from the Kumamoto Detective Office, province of the Japanese Ministry of Agriculture.

(2) In Apr. 2010, Wang Jingyan, a researcher from the Fruit Tree Research Institute of Chinese Academy of Agricultural Sciences detected the Mr Feng Nongmin, the 'fruit King' 's Apple, which planted with BGA soil conditioner and stored for half a year, still contains SOD 58.71unit/g. Wang pointed that, it is 20unit/g in the apple planted with fertilizer, 30unit/g by foliar application SOD enzyme preparation, but it is a miracle that it is 90unit/g (fresh fruit, detected in Japan) and 59unit/g (stored fruit, detected in China)with BGA soil conditioner.

3.5 治理荒漠，维护国家生态安全
Control desertification, to preserve National Ecological Security

国家生态安全是国家政治安全的基石，可以保障国家的可持续发展。生态环境直接关系到人类的繁衍和人类社会的发展，其安全与否已经受到国际社会的极大重视。它不仅关系到国家内部的社会稳定和经济发展，而且关系到整个国际社会的稳定和发展。生态安全是经济安全的保障，一个国家或地区只有维持自然资源的一定存量及生态系统的正常结构、恢复能力，才能保持经济的持续发展，否则就会威胁经济安全。全球陆地面积的 47%，即 5400 万平方公里受荒漠化的影响，并以每年 50 万平方公里的速度扩展。我国的生态问题非常严重，荒漠化面积 267.4 万平方公里，占国土面积的 27.9%。我国每年因荒漠化造成的直接经济损失达 540 亿元，平均每天损失近 1.5 亿元。虽然经过多年努力，我国防沙治沙事业已取得令人瞩目的成就，全国土地沙化由 20 世纪 90 年代末期年均扩展 3436 平方公里转变为现在年均缩减 1283 平方公里。但我国仍是世界上生态和环境建设十分脆弱的国家之一，局部地区土地沙化仍有明显恶化趋势。荒漠化已成为严重制约我国经济社会可持续发展的重大环境问题。

本公司用 BGA 土壤调理剂在治理荒漠化、生态恢复等方面都取得了一定成效。

Ecological security is the foundation stone of the national political security, which can ensure the sustainable development of the country. Ecological environment is directly related to human reproduction and development of human society. The international community has put great attention on the safety of that. It' s not only related to domestic social stability and economic development, but also related to the stability and development of the entire international community. Ecological security is the guarantee of economic security. Only if one country or region keeps a certain stock of natural resources and maintains normal structure and resilience of ecological systems, in order to maintain sustained economic development, and then it can hold the sustained development of economy. Otherwise the economic security will be threatened. 47% of global land area, which means 54 million square kilometers, is affected by desertification. Even more worse is that this figure is expansion of 500,000 square kilometers annually. The ecological problem is very serious in China. The desertification area is 2,674,000 square kilometers, equivalent to 27.9% of the total land area. Desertification in China results in direct economic losses of 54 billion RMB every year, with an average daily loss of nearly 150 million RMB. Although under years' efforts, the desertification in China has scored remarkable achievements, the land desertification has turned on reduction of 1,283 square kilometers annually at present from average expansion of 3,436 square kilometers annually in late 20th century. But China still is one of the countries with fragile ecological environment in the world, and desertification in some areas is still going more series. So desertification has become a seriously major environmental problem which restricts the sustainable development of economy and society in China.

Our company has made some progress on combating desertification and ecological restoration with the BGA soil conditioner.

3.5.1 BGA 土壤调理剂在民勤沙漠夏季造林和追施
BGA soil conditioner using in the summer planting and topdressing in Minqin Desert

民勤地处河西走廊东北部，我国第二大沙漠腾格里沙漠和第三大沙漠巴丹吉林沙漠之间，沙化面积已占全县国土面积的 94.5%，绿洲只剩 5.5%，年降水 110 毫米，蒸发量 2646 毫米，是全国乃至世界最干旱的地区之一。民勤处于全国荒漠化监控和防治的前沿地带，是中国北方沙尘暴的 4 大策源地之一，阻隔两大沙漠合拢，是中国西北部风沙线上的一座“桥头堡”。民勤绿洲不保，必将危及河西走廊，进而危及全国。因此这里是温家宝总理牵挂甘肃的头等大事，先后十多次发出指示：“决不能让民勤成为第二个罗布泊！”。本公司在总理指示感召下，在兰州军区司令员李乾元上将、甘肃省委省政府领导和中国防治荒漠化基金会的关心与支持下，连续两年用我们的产品 BGA 土壤调理剂进行植树造林试验，2006 年的造林取得了成功，2007 年夏季造林也取得初步成功。

Minqin is located in the northeast of the Hexi Corridor, between the China's second largest desert, Tengger Desert and the third largest desert Badanjilin Desert. Desertification land occupies 94.5% of on the total land in the county. Oasis only remains 5.5%, the annual precipitation is 110 mm, and evaporation 2646 mm. Minqin is one of the most arid regions in the nation even in the world. Minqin is at the frontier zone of national monitoring and control of desertification, and is also located in one of four major original places of sandstorms in northern China. It helps to keep these two big deserts from combination, and it' s a "bridgehead" on the sand line in northwest China. If we lose Minqin Oasis, it will endanger the Hexi Corridor, and then the whole nation. So here is top priority problem in Gansu Premier Wen Jiabao concerned about, who has issued instructions a dozen times: "Never allow Minqin to be a second Luobupo!." Impelled by the instructions from the Prime Minister, and under the kind care and support from Lanzhou Military Region Commander Li Qianyuan General, leaders from Gansu Government and the Foundation to Combat Desertification in China, we have tested our products BGA soil conditioner for two years, we have succeed in reforestation of 2006, also achieved initial success in reforestation of 2007 summer.

梭梭平均生长量(2007 年 7 月 1 日～ 2007 年 10 月 15 日)
The average growth of sacsaoul (Jul. 1, 2007 ～ Oct. 15, 2007) *cm*

日 期 Date		7月1日 Jul.1st		10月15日 Oct.15th		7月1日~10月15日 Jul.1st−Oct.15th	
处 理 Treatment	重复 Repeat	株高 Height	冠径 Diameter	株高 Height	冠径 Diameter	株高平均生长量 Average Height Growth Rate	冠径平均生长量 Average Diameter Growth Rate
对 照 Comparation	1	80	76.8	93.6	95.3	10.7	13.0
	2	80	75	90	90.6		
	3	83.4	68	92	83		
BGA 土壤调理剂 BGA Soil Conditioner	1	94	76.8	119	113	16.9	29.1
	2	79.4	51.8	93	78		
	3	93.8	65	106	90		

BGA 土壤调理剂梭梭夏季追施试验现场，梭梭大、叶绿、长势强劲。2008 年 9 月 25 日香港卫视记者海涛和邹玉璇在现场拍摄。2008 年 11 月 15 日、16 日向全世界播放。
Sacsaoul dressing test location of BGA soil conditioner, the sacsaoul is big, leaves are green, strongly grows. On Sept. 25, 2008, journalist Haitao and Zou Yuxuan from Hangkong TV were shooting at the location. It was transmitted to the world-wide on Nov. 15th, 16th 2008.

BGA 土壤调理剂梭梭夏季追施试验现场对面(公路北侧)的梭梭长势较弱，矮小，叶子发黄。
The opposite side of sacsaoul dressing test location of BGA soil conditioner, the sacsaouls were weak, short and with yellow leaves.

3.5.2 逆境条件下显著提高植树成活率，有利于生态建设 Enormously increase of survival rate of trees in adverse conditions

(1)内蒙干旱沙漠 Arid desert in Inner Mongolia

和林格尔县沙漠贫瘠、多风、极干旱（降水少于 150mm），用 BGA 土壤调理剂种油松成活 81.83%，山杏 38.50%，不用全为 0%，沙子被改造成沙质壤土。地处杭锦旗的库布其沙漠气温高、温差大、干燥、多大风，无人管护条件下刺槐成活率为 50%，传统方法植树难以成活。

The desert in Horinger County is barren, windy and extremely dry (<150mm precipitation). With BGA soil conditioner, the survival rate of Chinese Pine was 81.83% and that of Siberian Apricot was 38.50%. Without BGA, all trees were died. Kubqi desert in Hangjin Prefecture has high temperature, large temperature gap between day and night, dry, windy. With BGA soil conditioner, 50% yellow locust was survived, and the ones planted with traditional methods could not survive.

和林格尔县沙漠植树前
The desert in Horinger County before afforestation

和林格尔用 *BGA* 种植成活的油松
The survival Chinese Pine in Horinger with BGA soil conditioner

和林格尔不用 *BGA* 植树全部死亡
The Chinese Pine without BGA in Horinger were died completely

杭锦旗植树现场，成活率 *50%*

Afforestation site, the survival rate is 50%.

(2)北京门头沟的石质山地植树造林

Planting and forestry in the stony land of Mentougou, Beijing

温带大陆性季风气候，年均气温 11.6℃。用和不用 BGA 土壤调理剂一年成活率分别为：刺槐 97.66% 和 78.62%；火炬树 81.02% 和 28.08%；黄栌 82.70% 和 67.96%。二年后三种树的混合成活率用 BGA 土壤调理剂为 42%，不用为 2%。

Mentougou District, Beijing has temperate continental climate. The annual temperature is 11.6?. The survival rates with and without BGA soil contidioner were respectively 97.66% and 78.62% for yellow locust; 81.02% and 28.08% for staghorn sumac and 82.70% and 67.96% for common smoketree. After two years, the mixed survival rate for 3 kinds of trees was 42% for BGA and 2% without BGA.

种植前(*2000* 年 *11* 月)
Before transplanting on November, 2000

种植一年后(*2001* 年 *10* 月)
One year after transplanting on October, 2001

种植后近五年(*2005* 年 *7* 月)
Five years after transplanting on July, 2005

BGA 使根系发达
BGA soil conditioner makes more roots

(3)西藏山地绿化和荒漠化治理

Afforest and desert control to the mountains in Tibet

① 拉萨市南山海拔 3725 米，高原半干旱气候，气温低，日温差大，非常贫瘠，施用 BGA 土壤调理剂的松树成活率为 80%，不用为 20%。比如县海拔 4500 米，属亚寒带气候，干燥，多风，高寒，贫瘠，施用 BGA 土壤调理剂的松树成活率为 100%，不用为 0%。

The South Mountain in Lhasa, Tibet is 3725 m above sea level. It is the plateau semiarid climate. The temperature is low and the gap between day and night is great.The soil is very barren. With and without BGA soil conditioner, the survival rates were 80% and 20%, respectively. Biru County is 4500 m above sea level, with semifrigid climate, dry and windy, very cold. Soil is infertile. With and without BGA soil conditioner, the survival rates were 100% and 0%, respectively.

2005 年 4 月 20 日拍摄，3 年前用 BGA 种的云杉生长旺盛，远处(右上方)为传统方法种的侧柏和两棵较大的云杉

Dragon spruce planted 3 years ago treated by BGA soil conditioner is growing vigorously. Far away (right above) there are bigger Chinese arborvitae and 2 dragon spruce trees planted with traditional method.Photographed on April 20, 2005

2005 年 5 月 10 日拍摄，近处用 BGA 种植的云杉仍然旺盛生长，远处(右上方)传统方法种植枯死一株已被拔掉，侧柏也枯死变少了

The near dragon spruce treated by BGA soil conditioner is still growing vigorously. A dragon spruce far away (right above) planted with traditional method has died and pulled out. The Chinese arborvitae trees were dying and their population was reduced. Photographed at May 10, 2005

2005 年 6 月 25 日拍摄，近处用 BGA 种的高山柳正常生长。用传统方法种的二棵云杉已全部枯死都被拔去，补栽的侧柏仍然生长不好。*The near cupular willow treated by BGA soil conditioner is normally growing. The dragon spruce planted with traditional method has died and pulled out. The replanted Chinese arborvitae trees are still growing not well.Photographed at May 10, 2005*

② BGA 调理剂在西藏植树造林的成功引起了中国治理荒漠化基金会的关注并以本公司为技术支持在西藏自治区林业局和拉萨市林业局的支持下建立了实验基地。

The success of BGA conditioner in the afforestation in Tibet drew the attention of China Desertification Control Foundation, which established an experiment base with our company as the technical support and supported by Forestry Bureau of Tibet Autonomous Region and Forestry Bureau of Lhasa.

拉萨治理荒漠化试验基地

Base for desertification control experiment in Lhasa.

苗圃 *Nursery*

结合草方格在卡巴朗沙地种植榆树

Planting elms in Kabalang Sand Area with the straw checkerboard barriers

(4)废弃矿山的生态恢复 Ecological Recovery of Abandoned Mine

BGA 土壤调理剂在生态重建方面有独特的作用，在煤都辽宁抚顺废弃的页岩上成功地种植了各种作物，特别是在 2004 年海啸受灾国如马来西亚、巴林的生态重建发挥了任何其它产品都无法代替的作用。

BGA soil conditioner plays an import role in the ecological rehabilitation. Various crops were successfully planted on the abandoned shales in the Coal Capital of Fushun in Liaoning Province. It played an irreplaceable role in the ecological rehabilitation in the tsunami-stricken countries in 2004 such as Malaysia and Bahrain.

本公司科研基地在废弃绿色页岩上用 *BGA* 土壤调理剂剂种植大豆获得成功

Soybean with BGA soil conditioner successfully grew on abandoned green shale in base of our company

废弃页岩上用 *BGA* 土壤调理剂种植的火炬树较高

Staghorn sumac grew on abandoned shale on north slope treated with BGA soil conditioner was taller

未用 *BGA* 土壤调理剂种植的火炬树较矮

Staghorn sumac withoyt BGA soil conditioner was shorter

3.6 保水抗旱，开展节水农业，应对水危机

Water conservation and drought resistance, develop water-saving agriculture, to deal with water crisis

英国政府首席科学顾问约翰?贝丁顿最近指出，全球气温变化已成为当前全球最严峻环境挑战，若全球气温再上升 2℃，将有 10 亿～ 20 亿人面临水危机和粮食危机，中国将是最大受害者。2008 年中国北方小麦产区发生大面积旱灾，可以说是征兆之一。中国将会比全球气温上升的速度更快，若全球不采取措施，任凭温室气体排放，到 2050 年中国的气温就将上升 2℃，到本世纪末将上升 4℃，届时主要河流将严重断流，将有 10 亿人面临水资源危机。

我国是一个缺水严重的国家。淡水资源总量为 28000 亿立方米，占全球水资源的 6%，居世界第四位，但人均只有 2300 立方米，仅为世界平均水平的 1 / 4、美国的 1 / 5，在世界上名列 121 位，是全球 13 个人均水资源最贫乏的国家之一。到 20 世纪末，全国 600 多座城市中，已有 400 多个城市存在供水不足问题，其中比较严重的缺水城市达 110 个。北京市人均占有水量为全世界的 1/13，都不如一些干旱的阿拉伯国家。

BGA 土壤调理剂可以利用温差吸附水分并能吸氧生水，所以它具有很好的保水抗旱功能，能对缓解和解决水资源危机做出贡献

2008 年入冬以来一场历史罕见的旱灾袭击我国十多个省、区、市，全国耕地受旱面积近 3 亿亩，我国北方小麦主要产区出现严重干旱，旱灾范围之广、持续时间之长、受旱面积之大为五十年来之最，全国作物受旱面积 1.61 亿亩，严重威胁我国的粮食安全。

在严峻的形势面前，我们急国家之所急，于 2009 年 2 月 10 日至 14 日分两组深入河南、安徽、山东和河北四省田间，用我们的产品和行动直接参加抗旱斗争，取得非常好的效果。河南省灵宝市函谷关镇去年施用 BGA 土壤调理剂的一片麦田在去冬今春的大旱中出苗整齐、叶片肥厚、根系发达、土壤湿润松软，完全不显缺水迹象。周围没用 BGA 土壤调理剂的麦苗则疏密不一，麦芽低矮，叶片出现枯黄现象。河南省淮阳县土肥站的试验结果是：底施 BGA 土壤调理剂 80 公斤 / 亩，小麦产量为 562.9 公斤，比底施 45% 复混肥 50 公斤 / 亩的小麦产量 369.1 公斤 / 亩增产 52.5%；在底施 45% 复混肥 50 公斤 / 亩基础上追施 50 公斤 / 亩 BGA 土壤调理剂小麦产量为 550 公斤 / 亩，增产 49.0%。四川省广汉市三星镇农民刘兴财在因严重虫害而要放弃的小麦上喷施 BGA 叶面肥，产量达 530 斤 / 亩，比不喷 BGA 叶面肥而按常规施化肥和农药的小麦亩产 240 斤增产 120.8%。

John Bedding, Chief Science Adviser of British government, appointed that the climate change had become the most serious challenge of global environment, if the global temperature rises two degrees more, then one billion to two billion people will face water crisis and food crisis, and China will be the biggest victim. The wheat large areas drought in northern China in 2008 can be viewed as a sign. It will be more rapid in China than in other counties, if no measures will be taken, let the greenhouse gases out, by 2050 the temperature in China will increase 2?, to the end of this century will be 4 ?, then the major rivers will severely dried up, which will make one billion people facing water crisis.

Water in our country is in a serious shortage. The total fresh water resource is 2.8 trillion cubic meters, accounting for 6% of the global water resources, ranking the forth in the world, but only 2300 cubic meters per capita, only the world average of 1/4, United States 1/5 in the world ranked 121, is one of the most water-shortage countries in the world. The individual occupy water is 1/13 of the world, not better than some droughty Arab countries.

BGA soil conditioner can use temperature difference to adsorb water and take oxygen to become water, so it has good functions of water consenvation and drought resistance, and can make efforts to relax and solve the water crisis.

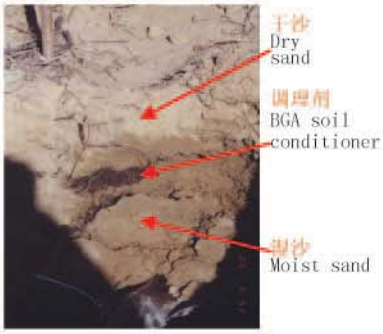
Since the winter in 2008, a rare drought in the history hit more than ten provinces, autonomous regions and municipalities, the national land area of nearly 300 million mu(20 million ha) results in north China, the main production of wheat drought, severe drought broad scope and duration of the long, then the area is fifty years, the results of the crop area 161 million mu(10.73million ha), serious threat to China's food safety

In the severe situation, we worried about what the country worried about, from Feb. 10-14, 2009, we divided to two groups to Henan, Anhui, Shandong and Hebie Provinces field, products and operations with our direct participation of drought struggle to obtain very good results. The Hanguguan County in Lingbao, Henan Province, the field with BGA soil conditioner last year was of the condition with lade root, thick, soft, moist soil, water signs not completely under the severe drought during the spring. While the ones around without BGA were of different density is replenished, malt yellow leaves and low appearances. The experimental result at the local Fertilizer Station of Huaiyang County, Henan Province was: the BGA basal fertilizer 1,200 kilograms/ha, and the wheat yield was 8,443kg/ha kilograms, while it was 5,536 kg/ha with 45% basal compound fertilizer of 750kg/ha, the yield was 8,250kg/ha increased by 52.5%. If at the base of 45% basal compound fertilizer of 750 kg/ha, 750 kg/ha BGA soil conditioner was dressed, the yield increased by 49%. Mr. Liu Xingcai, a farmer at Sanxing Town, Guanghan, Sichuan Province, sprayed BGA foliar fertilizer before nearly give up influenced by the severe pestis damage, the yield was 3,975 kg/ha, 120.8% more than the wheat used normal chemical fertilizer or pesticide instead of BGA foliar fertilizer.

3.6.1 土壤含水量比较　Comparison of soil water content

地点及土质 Place and soil texture		北京市门头沟石质山地 Rocky mountain in Mentougou, Beijing								内蒙干旱沙漠 Arid desert in Inner Mongolia		公司基地沙子 Sand in the base
时间 Time		苗木发芽前 Tree seedling before budding 2001.3.26		灌溉前 Before irrigation 2001.5.29			灌溉后 After irrigation 2001.7.15			2001.5		2001.10.31 ~2002.6.10
层次 Layer /cm		0~20	20~40	0~5	15~20	30~35	0~5	15~20	30~35	山杏 Apricot	油松 Pine	3.8 (01.10.31)
含水量 Moisture content%	BGA	26.48	11.24	2.8	11.5	11.2	5.6	7.4	11.2	27.0	21.2	6.24 (02.6.10)
	CK	7.25	7.00	2.4	7.4	8.2	5.3	6.7	5.7	4.8	2.3	0.64 (02.6.10)

3.6.2 土壤剖面 Soil profile



3.6.3 海南胡椒不浇水耐旱试验

No water anti-drought test to pepper in Hainan

用 BGA 土壤调理剂的胡椒仍生机盎然，用化肥的胡椒全部枯死：

Drought resistant experiment without irrigation: the pepper with BGA soil conditioner still grows normally, the pepper with chemical fertilizers died completely.

用 *BGA* 土壤调理剂 *The pepper with BGA soil conditioner*

用化肥 *With chemical fertilizers*

3.6.4 重庆万州瀼渡镇 Rangdu Town of Wanzhou, Chongqing

2001 年 104 天不降雨，用 BGA 土壤调理剂的番茄生长旺盛采摘 12 茬果，用化肥的采 3 茬后枯死

In 2001, there were 104 days with no rain, the tomatoes with BGA soil conditioner grew thickly, 12 crops were harvested, however, the tomatoes with chemical fertilizer died without water after 3 crops were harvested.

用 *BGA* 土壤调理剂 *The tomato with BGA*

用化肥 *With chemical fertilizers*

3.6.5 河南省灵宝市函谷关镇 Hanguguan Town in Lingbao, Henan Province

2009 年初华中地区遭受严重旱灾，农民在 2008 年秋使用 BGA 种植的冬麦没有受到旱灾影响，生长正常，而未施用 BGA 种植的小麦叶面枯黄，难以生长。

Great drought hit Central China at the beginning of 2009. The winter wheat planted with BGA in the fall of 2008 was affected by the drought and grew normally. However, the wheat planted without BGA had yellow and dry leaves, which is difficult to grow.

未使用 *BGA* 土壤调理剂种植的冬麦叶面枯黄
The winter wheat without BGA soil conditioner has yellow and dry leaf surface

使用 *BGA* 土壤调理剂种植的冬麦生长正常
The winter with BGA soil conditioner wheat grew well

施用化肥的麦苗大旱过后叶片仍然卷曲、发黄，长势不旺
The wheat with chemical fertilizer still had curved and yellow leaves after the drought, and didn't grow well

施用 *BGA* 土壤调理剂的麦苗大旱过后叶片舒展、油绿，长势旺盛
The wheat with BGA soil conditioner had unfolded and yellow leaves after the drought, and grew well

3.6.6 河南省灵宝市焦村镇姚家城村
Yaojiacheng Village of Jiaocun Town, Lingbao, Henan Province

农民常运虎 2008 年 11 月 2 日播种，晚播种近一个月，与施用化肥种植的小麦对比，BGA 小麦麦穗较长，颗粒饱满，穗粒多，亩产达 340.6 公斤，较化肥种植的小麦增产 38.7%。

A farmer called Chang Yunhu sew the seeds on Nov. 2, 2008, nearly one month later than regular , and the comparison is that the wheats used BGA were longer-ears, more and fuller-grains, the yield is 5,109kg/ha, 38.7% more than wheats used chemical fertilizer.

左：用 *BGA* 土壤调理剂种植的小麦植株较高且粗壮
Left: wheats with BGA soil conditioner are higher and stronger
右：用化肥种植的小麦植株较矮且抽穗不均匀
Right: Wheats with chemical fertilizer are shorter and ears are not nonuniform

左：用 *BGA* 土壤调理剂种植的小麦植株较高且粗壮
Left: wheats with BGA soil conditioner are higher and stronger
右：用化肥种植的小麦植株较矮且抽穗不均匀
Right: the ones with chemical fertilizerare shorter and fewer grains.

3.6.7 河南省淮阳县土肥站
Soil Fertilizer and Station in Huaiyang Town, Henan Province

2008 年 10 月和 2009 年 3 月淮阳县土肥站分别在郑集乡和王店乡对小麦进行了 BGA 土壤调理剂底施和追施实验，追施比对照群体多 3.4 万，穗粒数增 8.8 粒，千粒重 41g，理论产量 550kg/ 亩，增长 181kg，增产效果显著。

We separately tested the wheats of BGA soil conditioner as basal fertilizer and top fertilizing at Zhengji and Wangdian Villag of the Soil and fertilizer Station in Huaiyang Town in Oct. 2008 and Mar. 2009. The top fertilizing was 34 thousands more, number of grain increased 8.8 more, the weight per thousand grains was 41g, the theorical production was 8,250kg/ha, which is 2,715kg/ha more, the production increased notably.

3.6.8 节水农业　　Water-saving agriculture

北京林业大学硕士研究生在本公司科研基地做毕业论文试验，结果用 BGA 土壤调理剂的草坪节水 1/3.

A postgraduate of Beijing Forestry University tested in the base of our company. Water was saved by 1/3 with BGA soil conditioner..


BGA 激活剂应用于培育草坪的土壤中
节水性能的研究

研究报告
Research report

试验现场
Trial site

(2)水稻旱种在浙江省东阳市和本公司基地都获得成功。

Paddy rice grown on upland succeeded both in Dongyang city, Zhenjiang and in our company

浙江东阳 *BGA* 土壤调理剂首次旱种水稻亩产就达 *430* 公斤
Paddy rice grown on upland yielding 6450kg/ha in Dongyang city, Zhenjiang

本公司科研基地的旱种水稻也获得丰收
Paddy rice grown on our base gained harvest

3.7 增强作物抗性,抵御自然灾害,减少农民损失,力争灾年丰收
Enhance crop resistance against natural disasters, reduce the crippling loss, and strive to harvest in the year of disaster

我国幅员辽阔，地理气候条件复杂，是世界上受自然灾害影响最为严重的国家之一，灾害种类多、发生频率高、损失严重。我国最常发生的灾害有洪涝、干旱、地震、台风和滑坡泥石流等 5 种，所造成的损失占损失总量的 80% 至 90%。1949 年以来，我国平均每年因自然灾害造成的直接经济损失在 1000 亿元人民币以上，农作物受害面积年均超过 4000 万公顷，受灾人口年均超过 2 亿。

BGA 土壤调理剂在作物抗旱、抗寒、抗热、抗虫等方面都有突出表现，BGA 土壤调理剂抗旱情况已经介绍过，下面介绍抗寒、抗热、抗虫情况。

China has a vast, complex geography and climate condition, and it is one of the most severe of being affected by nature disasters, with various types of disasters, high happen frequency and sever losses. The most common disasters are floods, droughts, earthquakes, typhoons and landslides, mudslides, etc., and the loss takes 80% to 90% within the total ones. Since 1949, China's average annual result of natural disasters caused direct economic losses of more than 100 billion yuan, the acreage of crops average more than 40 million hectares, an average more than 200 million affected people.

BGA soil conditioner has an outstanding performance in crop drought, cold, heat, insect-resistant, for its drought resistance, we have introduced before, we will introduce the cold, heat, insect-resistant case in the following.

3.7.1 抗寒 Cold resist

2008 年初我国南方一些地区的农作物遭受低温冻害袭击，截至 2008 年 2 月 1 日上午，湖南、湖北、江西、贵州等 20 个省份的作物受灾面积发展到 1.41 亿亩，其中成灾 6629 万亩，绝收 1628 万亩。河南灵宝市也遭遇了 50 年未遇的特大冻灾，用化肥种植的大棚蔬菜深受其害，用 BGA 土壤调理剂的大棚蔬菜安然度过难关，获得可喜收成。

In early 2008 crops in some parts of southern China suffered low-temperature damage attacks, as February 1, 2008 morning, Hunan, Hubei, Jiangxi and Guizhou Provinces in 20 affected areas of crops grown to 9.4 million hectares, of which 4.42 million hectares of disaster, 1.09million hectares of crops sow nothing . Lingbao Henan suffered a serious freeze disaster have not seen for 50 years, also the greenhouse vegetables grown with chemical fertilizers suffered, with the BGA's soil conditioner greenhouse vegetable survived, was gratifying harvest.

没用 *BGA* 土壤调理剂的黄瓜冻害严重，枯萎、死苗，减产七成以上
Cucumber without BGA got chill disaster, wilt and dead. Yield drop was more than 70%

用 *BGA* 土壤调理剂作底肥、喷 *BGA* 叶面肥的黄瓜，香、甜、脆，*6* 分棚收入 *5000* 多元。
Cucumber with BGA soil conditioner as base application and sprayed BGA foliar fertilizer was fragrant, sweet and crisp. The revenue was more than 5000 RMB per greenhouse of 0.6 mu

用 *BGA* 土壤调理剂作底肥、喷 *BGA* 叶面肥的西葫芦，生产正常，*6* 分棚收入 *5000* 多元。
Squash with BGA soil conditioner as basal fertilizer and sprayed BGA foliar fertilizer grew normally, sweet and crisp. The revenue was more than 6000 RMB per greenhouse of 0.6 mu(600m2)

BGA 土壤调理剂抗寒的一个原因在于它能提高冬季土壤温度。中国林科院首席科学家、原副院长慈龙骏教授等 4 人 2003 年 1 月 17 日夜在宁夏永宁的塑料大棚中通过 50 多个测温点测得施用 BGA 土壤调理剂的土壤温度比不施的提高 2.4℃。河南灵宝农民赵宏波 2007 年冬在其家乡也测得完全相同结果。

Raise temperature on soil in winter， Professor Ci Longjun, the chief scientist and vice-president of Chinese Academy of Forestry and so on 4 people determinated soil temperature in Ningxia on Jan. 17,2003:the temperature with BGA higher 2.4℃than without BGA. Mr. Zhao Hongbo , a farmer in Henan obtained the same result as Professor Ci in winter 2007 in Henan .

中国林科院原副院长、首席科学家慈龙骏教授(右)与本公司技术人员在宁夏测土壤温度
Chief scientist, professor Ci Longjun (right), deputy director of Chinese Academy of Forestry Sciences was checking soil temperature with technician of our company in Ningxia Autonomous Region

3.7.2 抗虫 Pest resistant

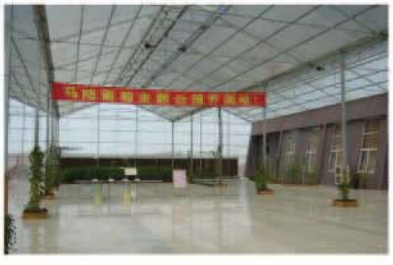
鞍山市特等劳动模范、海城市农民水稻专家刘洪生在 BGA 产品新闻发布会上曾介绍他用 BGA 土壤调理剂种植水稻有驱虫作用，不用打农药，水稻田里可养虾蟹。

Liu Hongsheng, expert at rice planting in Haicheng, labour model in Anshan, once introduced some experiences of rice planting without chemical fertilizer, and the rices with BGA soil conditioner had the function to driving away pests, and you could raise crabs in the rice fields.

3.7.3 抗热 Heat resistant

上海嘉定区马陆葡萄主题公园接待大厅由原来的 2 个建筑物中间搭建玻璃作为屋顶，地面铺以瓷砖，东西两端用玻璃封闭和做门。种植环境非常恶劣：不通风，无法调温，极其干燥。作物生长后期 6 ～ 8 月份，白天平均室温 38℃ ～ 45℃，晚上 35℃左右(8 月 12 日下午 3 时测定室温高达 55℃)，不利于植物正常生长、开花座果。在瓷砖上用 BGA 土壤调理剂我们成功种植了水稻、西瓜、南瓜、苦瓜、黄瓜、茄子、樱桃西红柿、蛇豆等。

The glass roof was put on between 2 buildings. The floor was ceramic tile. Glass walls were standing on east and west, with glass doors. The growing condition was extremely bad: no ventilation, no temperature control and very dry. In late crop growing season in June-August, the daylight room temperature was 38℃ −45℃ , and night temperature was 35℃ (it was 55℃ at 15 pm on August 12), which was unsuitable for crop normal growth, flowering and fruiting. We planted rice, watermelon, pumpkin, bitter gourd, Hami melon, cucumber, sesame, eggplant, mini-tomato, leaf beet, tuber gourd and cowpea. All crops grew successfully, except Hami melon, sesame, tuber gourd and cowpea due to high temperature before ripe or fruiting.



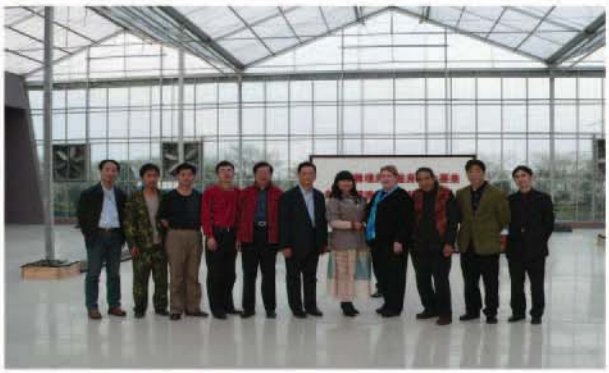
用 *BGA* 土壤调理剂的种植现场 *Site of planting*

樱桃西红柿 *Mini-tomato*

旱种水稻已抽穗 *High-land rice earring*

绿色南瓜 *Green pumpkin*

红色南瓜 *Red pumpkin*



美国农业专家 *(右 4)* 日本客人 *(右 5)* 参观试验现场
USA agronomists (fourth from right) and Japanese agronomists (fifth from right) accompanied by professor Wang Kaifeng of Tongji University visited experiment site

3.8 增强光合作用，提高作物产量，加快经济林建设
Enhance photosynthesis, raise the crop output, and accelerate construction of economic forest

一般说 BGA 土壤调理剂可使催芽期缩短 1 ～ 2 天，出芽率提高 5%～ 10%，育苗期缩短 15 ～ 20 天，结果期提前 10 ～ 20 天，采收期延长 10 ～ 15 天。叶片数增加 1.2 ～ 1.5 倍，叶片大 1.2 ～ 3.8 倍，叶绿素含量平均增加 13%～ 24%。平均株高增长 1.1 ～ 4 倍。BGA 土壤调理剂显著地提高植物的光合作用速率，所以能够较大幅度地提高作物产量和经济林生长速度，使农民增产增收。

Generally, BGA soil conditioner can reduce germination period the 1 to 2 days, sprouting rate raised 5% to 10%,raise seedling period shortened from 15 to 20 days, the result of 10 to 20 days in advance, harvest period is extended from 10 to 15 days. Leaf number increased from 1.2 to 1.5 times, 1.2 to 3.8 times the large leaves, chlorophyll content increased by an average 13% ~ 24%. BGA soil conditioner to improve significantly the rate of photosynthesis of plants so can greatly improve crop yield and economic forest growth rate, so that farmers increase production.

3.8.1 宁夏试验 Ningxia Tests

(1)碱地水稻 Rice in alkaline land

宁夏农科院 2010 年在龟裂碱土上进行水稻种植试验，结果表明：施用 BGA 土壤调理剂提高了水稻叶片光合速率和蒸腾速率，降低了叶片瞬时水分利用效率，见下表和图。

Ningxia Academy of Agricultural Sciences tested in the chap alkaline land to plan rice in 2010, and the result certified that the rice with BGA soil conditioner raised leaf photosynthetic rate and transpiration rate, and lower the IWUE of leaves, showed in the picture below:

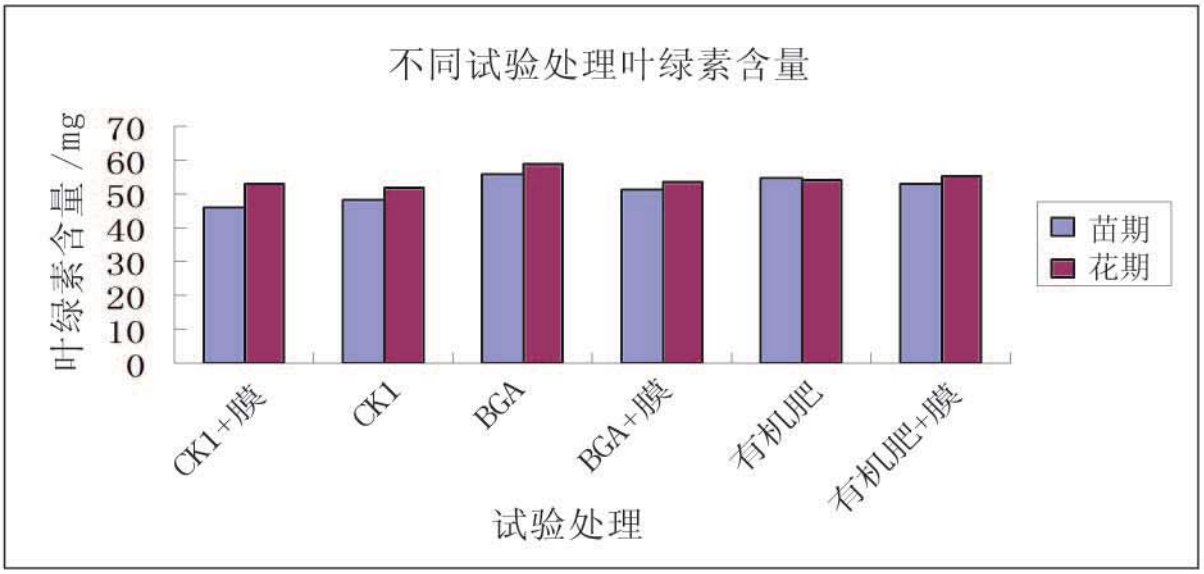
不同处理间水稻生理指标的比较 Comparison of rice in different periods

生育期 birth period	指标 data	无肥对照 without fertilizer	配方施肥 formula fertilize	BGA土壤调理剂 BGA soil conditioner
幼苗期 seeding stage	净光合速率/ u mol CO_2 m^{-2} s^{1} rate of net photosynthesis	6.67 A	8.26 AB	9.51 B
	蒸腾速率/ mmol H_2O m^{-2} s^{-1} transpiration rate	3.81 A	5.02 AB	5.29 B
	水分利用效率/ u mol CO_2 $mmol^{-1}$ H_2O Water use efficiency	1.76 A	1.65 A	1.80 A
拔节期 jointing stage	净光合速率/ u mol CO_2 m^{-2} s^{-1} rate of net photosynthesis	10.77 A	12.71 B	14.04 C
	蒸腾速率/ mmol H_2O m^{-2} s^{-1} transpiration rate	2.14 A	3.65 B	3.68 B
	水分利用效率/ u mol CO_2 $mmol^{-1}$ H_2OWater using efficiency	5.03 A	3.48 B	3.82 B
扬花期 flowering period	净光合速率/ u mol CO_2 m^{-2} s^{-1} rate of net photosynthesisd	13.38 A	15.17 AB	16.57 B
	蒸腾速率/ mmol H_2O m^{-2} s^{-1} transpiration rate	4.54 A	6.61 A	6.75 A
	水分利用效率/ u mol CO_2 $mmol^{-1}$ H_2O Water use efficiency	2.95 A	2.30 B	2.45 B

(2) 马铃薯 Potato

宁夏农科院通过试验认为，施用 BGA 土壤调理剂可使马铃薯生育期提前，叶绿素含量提高，株高、冠幅、叶片数增加，对马铃薯的净光合速率、蒸腾速率和细胞间 CO2 浓度、叶片气孔导度都有所增加。因此可以说施用 BGA 土壤调理剂对马铃薯的生理、生长势都起到了很大的作用。

Ningxia Academy of Agricultural Sciences through the test that the application of BGA soil conditioner can potato growth period ahead, chlorophyll content, plant height, crown width, leaf number increased, the net photosynthetic rate of potato, transpiration rate,and intercellular CO2 concentration and leaf stomatal conductance have increased.It can be said BGA soil conditioner have played a significant role in application on potato physiology, growth potential.

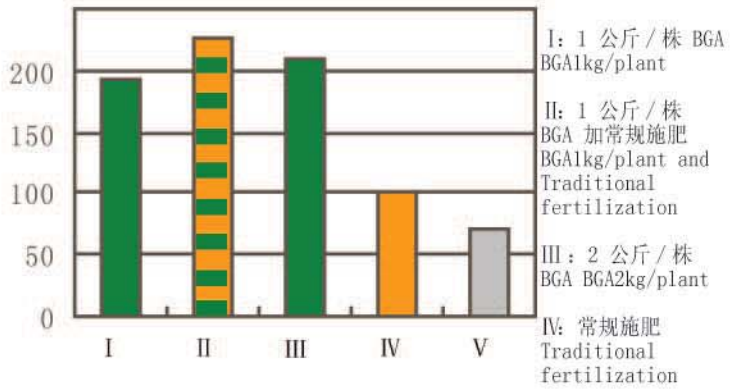


3.8.2 广东省湛江用 BGA 土壤调理剂种植的桉树

Eucalyptus planted with BGA soil conditioner in Zhenjiang, Guangdong Province

施用 BGA 土壤调理剂的桉树树高、胸径、材积明显高于常规施肥，8.5 个月材积增长几乎超过 1 倍，张新时院士和中国林科院原副院长慈龙骏教授亲临考察。

Eucalyptus treated by BGA soil conditioner in Zhanjiang, Guangdong. The height, trunk diameter and lumber accumulation of eucalyptus are higher than that treated by traditional fertilization. The volume of wood increased almost double within 8.5 months. Academician Zhang Xinshi and Professor Ci Longjun were visiting the site.



施用后 *8.5* 个月桉树材积变化
Changes to eucalyptus after 8.5 months

施用 *BGA* 土壤调理剂的桉树径粗约 *6* 厘米，树高 *6* 米以上，叶大、叶密、叶绿。
The trunk diameter of eucalyptus treated by BGA soil conditioner was 6 cm, height of plant was higher than 6 m with larger, denser and greener leaves.

施用桉树专用复混肥的桉树径约 *4～5* 厘米，树高约 *4* 米，叶较小，并且叶色已开始变黄。*The trunk diameter of eucalyptus treated by specific compound fertilizer was 4-5 cm, height of plant was 4 m with smaller and more yellow leaves.*

3.8.3 海南省热带经济作物
Tropical High economic value crops in Hainan Province

中国热带农科院在海南省试验用 BGA 土壤调理剂种植比用等量国外名牌高浓度复混肥种植的橡胶增粗快，胡椒提前半年封顶，提前一年结果，香蕉提前 2 月采果，棕榈叶多、密、绿，毛叶枣树更高、叶更绿、果大、果多、落果少，火龙果和荔枝都长得快且节省施肥费用，芒果树叶片浓率、平展、顶稍长。张新时院士和慈龙骏教授也曾亲临考察。

Experiments conducted by Chinese Academy of Tropical Agricultural Sciences in Hainan. BGA soil conditioner treatment made rubber trees thicker trunk than famous foreign high concentrated compound fertilizer. Pepper grew to the top of pole half a year earlier. Banana picked-up 2 months earlier. Palm tree had more, denser and greener leaves. Hair-leaf jujube grew taller, with greener leaves, bigger and more fruits, lesser fruit dropping. Fortune firethorn and litchi grew faster and fertilization cost declined. The leaves of mango were dark green, flat, and the top of branch were longer. Academician Zhang Xinshi and Professor Ci Longjun have visited the site.

(1) 橡胶 Rubber

张新时院士(左一)和慈龙骏教授(左三)考察橡胶试验情况 *Academician Zhang xinshi and Professor Ci Longjun was visiting the site of rubber plantation*

海南橡胶效益对比试验〉左侧为施 *BGA* 土壤调理剂的橡胶树，右侧为施化肥的橡胶树
Hainan Rubber contrast test, the rubber trees on the left applied BGA soil conditioner, right side of the rubber trees used normal fertilizer

(2) 胡椒 Pepper

海南彬树山农场胡椒效益试验(等量施用)2002 年 6 月 12 日定植，2002 年 7 月 2 日第一次调查，8 月 1 日第二次调查，9 月 2 日第三次调查。

Pepper Tree Hill Farm Hainan Pepper efficiency test (equivalent application) planted June 12, 2002, July 2, 2002 the first survey, August 1 second survey, September 2 third survey.

胡椒主蔓长和株围 Length of Main Trailing and Plant Perimeter of Pepper

cm

用量 dosage	施肥品种 Fertilizer type	2002年7月2日				2002年8月1日				2002年9月2日			
		主蔓长 Length of main trailing	差 balance	株围 Plant Perimeter	差 Balance	主蔓长 Length of main trailing	差 balance	株围 Plant Perimeter	差 Balance	主蔓长 Length of main trailing	差 alance	株围 Plant Perimeter	差 Balance
0.3kg/株	BGA 土壤调理剂 BGA soil conditioner	27.1	4.0	93.3	12.0	47.4	7.4	99	12	69.9	2.9	106	15
	挪威高浓复混肥 Norway high-concentration fertilizer	23.1		81.3		40.0		87		67.0		91	
0.5kg/株	BGA 土壤调理剂 BGA soil conditioner	28.1	0.5	103	9.0	48.3	2.5	109	11	71.0	5.7	116	13
	挪威高浓复混肥 Norway high-concentration fertilizer	27.6		94		45.8		98		65.3		103	

(3) 海南小桐子树(麻疯树)Jatropha curcas tree in Hainan

能源危机已步步紧逼人类社会，各国都在极力寻找石油替代品，小桐子树是较好的品种之一。我们委托中国热带农科院原副院长谢发成研究员在海南省定安作试验，已初见成效，正扩大试验，这是一个具有方向意义的重大课题。

Energy crisis, human society has been pressing harder and harder, countries are struggling to find alternatives to oil, Jatropha tree is one of the better varieties. We commissioned the former Vice President of the Chinese Academy of Tropical Agricultural Sciences research fellow Xie Facheng in Ding' an,Hainan Province, it has given initial results and the experience is expanding, which is a major issue with the direction of significance.

课题负责人谢发成研究员(右)向来海南考察的中国生产力学会副会长兼秘书长陈胜昌教授介绍试验情况 *Researcher Mr. Xie Facheng, who in charge of the project (right) is introducing the test to Professor Chen Shenagchang, vice chairman & secretary-general of Chinese Productivity Society who went to inspect.*

右侧是用 *BGA* 土壤调理剂种植的小桐子树，生长量比左侧同期用其它肥料种植的小桐子树大得多 *On the right is wth BGA, while the left is*

小桐子树种植 *5* 个月后就能开花结果
Bloom 5 months after planted

施用 *BGA* 土壤调理剂的小桐子树去年冬天约有 *70%* 叶子仍留在树上(颜色深的叶子)，施其它肥料的树叶子全部掉光 *With BGA, 70% of the leaves remains in the tree, while other ones fell completety.*

3.8.4 重庆市万州区(三峡工程库区)山顶贫瘠的紫色土

Infertile purple soil on hill top of Wanzhou District, Chongqing (the Three Gorges Reservoir)

BGA 土壤调理剂重庆市万州区瀼渡镇(三峡工程库区)试验区全景
Panoramic Scene of BGA soil conditioner in Riangdu Town, Wanzhou District, Chongqing (the Three Gorges Reservoir)

不施肥的木豆株高 *58* 厘米
The cajan without BGA soil conditioner and fertilizer is 58cm high

施化肥的木豆株高 *196* 厘米
The cajan with chemical fertilizer is 196cm high

施用 *BGA* 土壤调理剂的木豆株高 *206* 厘米
The cajanus cajan with BGA soil conditioner is 206cm high

施用 *BGA* 土壤调理剂的木豆已开花结果
The cajanus cajan with BGA soil conditioner is blooming

使用 *BGA* 土壤调理剂的江蔬一号西红柿幼苗株高 *10.5cm*，并已现蕾
Jiangshu No.1 tomato seedling with BGA soil conditioner is 10.5cm high, and the flower-bud appearing appeared

未用 *BGA* 土壤调理剂的江蔬一号西红柿幼苗株高 *3cm*
Jiangshu No.1 tomato seedling without BGA soil conditioner is 3cm high

左：未施 *BGA* 土壤调理剂的梨树大部分枯死，全未结梨。中：施了 *BGA* 土壤调理剂的梨树当年成活率达 *90%*，并有两株结果。右：一年半后用 *BGA* 土壤调理剂的梨树 *80%* 结梨，而未施 *BGA* 土壤调理剂的 *800* 棵梨树 二年半也无一开花结果
Left: Most of the pear trees without BGA soil conditioner died without water, and none of the trees had fruit Middle: 90% of the pear trees with BGA soil conditioner lived in that year of planting, and two produced fruit Right: there are pears on 80% of the trees after one and a half years with BGA soil conditioner, while without BGA, the other 800 pear trees all died and without any fruit even after two and a half years.

3.8.6 江苏省徐州市的大棚蔬菜 Vegetables in plastic tunnel in Xuzhou, Jiangsu Province

2007 年在江苏省徐州市的大棚蔬菜生产全过程应用 BGA 土壤调理剂和 BGA 叶面肥，都取得了成功。

BGA soil conditioner and BGA foliar fertilizer was used to the vegetables in plastic tunnel in Xuzhou, Jiangsu Province and it gained success.

育苗期　左：*BGA* 土壤调理剂，根系发达、苗绿苗壮；右：常规肥，根少、叶发黄、苗弱
Nursery Stage Left: BGA soil conditioner Strong root system, green and strong seedling; Right: conventional fertilizer, fewer roots, yellow leaves and weak plants

幼苗期　左：*BGA* 土壤调理剂，苗齐、苗壮；右：常规肥
Seedling Stage Left: BGA soil conditioner. The seedlings are uniform and strong; Right: conventional fertilizer

喷施 *BGA* 叶面肥 *5* 天后
左：*BGA* 土壤调理剂；
右：常规肥
5 days after spraying BGA folia fertilizer
Left: BGA soil conditioner; Right: conventional fertilizer
Seedling Stage

追施 *BGA* 土壤调理剂 *10* 天后
左：*BGA* 土壤调理剂，高、壮；
右：常规肥
10 days after dressing BGA soil conditioner
Left: BGA Soil conditioner, high and strong; Right: conventional fertilizer

成熟期　左：常规肥；
右：*BGA* 土壤调理剂，高、壮
Autumn period
left:conventional fertilizer; R: BGA soil conditioner

施用 *BGA* 土壤调理剂
Use BGA soil conditioner

施用常规肥
Applying Conventional Fertilizer

施用 *BGA* 土壤调理剂香、甜、脆，恢复了黄瓜的原有风味
After BGA soil conditioner is applied, the cucumbers are delicious, sweet and recovers its flavor.

3.8.7 河南省灵宝市 Lingbao, Henan Province

地处豫西，盛产优质苹果和大枣。用 BGA 土壤调理剂种植的苹果幼苗长得快，移栽一年后平均株高 2.30 米，平均茎围 9.67 厘米，用化肥同时移栽的同样苗平均株高 1.48 米，平均茎围 4.00 厘米三年，老乡说用 BGA 的苗一年顶三年，二年后就开花结果。用 BGA 土壤调理剂种植的苹果着色好，甜、脆，抗氧化，耐储存，价格高，易销售。

Located in West Henan, it has a large production of high-quality apples and dates. The little apple plant with BGA soil conditioner grew rapidly. After one year' s transplant, the average height of plant is 2.3m, and the average width is 9.67cm; while height of the ones with chemical fertilizer is 1.48m, and the width is 4.00cm after 3 years. The fellow-villagers said that one year of the BGA plants equals to 3 years of the normal ones, and it bloomed and fruited after only two years. The apples are good-colored, sweet, crisp, antioxidant, able to be stored, high price and easy to be sold.

施用常规肥 *Applying conventional fertilizer*

施用 *BGA* 土壤调理剂 *Using BGA soil conditioner*

3.8.8 宁夏永宁县成功试验了多种作物效果明显
Significant effect on various crops tested in Yongning, Ningxia

施用 *BGA* 剂的豆子
Soybean with BGA soil conditioner

施用常规化肥的豆子
Soybean with traditional chemical fertilizer

施用 *BGA* 的黄瓜
Cucumber with BGA soil activator

施用常规化肥的黄瓜
Cucumber withtraditional chemical fertilizer

3.8.9 广东惠州
Huizhou, Guangdong Province

木瓜、荔枝等热带水果施用 BGA 土壤调理剂后提高产量，改善品质，一个木瓜有 5 升矿泉水桶大。

Pawpaw, litchi and other tropical fruit with BGA have a larger yield, higher quality. One pawpar is the of the same size as a water barrel of 5L.

3.9 水泥地和瓷砖上的种植
Planting on Cement Ground and Ceramic Tile

BGA 土壤调理剂能够在水泥、瓷砖等特殊材料上种植，以解决人们的一些特殊需要。

BGA soil conditioner can be planted on special materials such as cement and ceramic tiles so as to meet some special demands.

3.9.1 瓷砖上的种植 （见第 28 页“3.7.3 抗热”的有关内容）

Planting on Ceramic Tile See Page 28 3.7.3 Heat Resistance for related information.

3.9.2 在本公司水泥地和(或)塑料薄膜上种植

Growing on cement ground or plastic film in our company.

温室内水泥地面种小麦
Wheat grew on cement ground in greenhouse

室外水泥地面种小麦
Wheat grew on cement ground outdoor

水泥地面种的西红柿
Tomato grew on cement ground

水泥地面种的芝麻高达 2.4 米
Sesame grew on cement ground as high as 2.4 m

塑料大棚内在塑料薄膜上旱种水稻已获丰收
Bump harvest of paddy rice upland growing on plastic film in plastic tunnel

在水泥地面种草绿化，发达的根系像毡子一样
Turf grew on cement ground

在垂直的水泥墙面种草绿化
Turf grew on cement wall

在垂直的水泥电线杆上种草绿化
Plant grass on the vertical cement electric pole

3.10 在能谱理论指引下，开辟诊治作物病害新道路
Under theguidance of the energy spectrum theory, diagnosis and treatmentof crop diseases to open up new roads.

苹果腐烂病、根腐病，槟榔黄化病，大枣枣疯病，生姜姜瘟病、烂脖子病，柑橘黄叶病等作物病害都久治不愈，成为世界性难题，甚至被称为“作物的癌症”。为避免传染，有些染病果树只能砍伐烧毁，严重地影响了主产地的经济发展。根据大量试验事实，我们在世界上首次提出了“土壤能谱”的新观点，并在这一新观点指导下研究开发了新产品——“病害作物专用型 BGA 土壤调理剂”。近两年来，为解决这些难题，用新产品做了一些试验工作，取得了很好的实际效果和理论突破。

Apple canker, root rot, yellowing disease of betel nut, jujube infacted, ginger, rotten neck disease, citrus yellow leaf disease and other crop diseases have long treatment, a worldwide problem, and even called the "cancer of crops". To avoid infection, some infected trees cut down only burned, severely affected the main producing area of economic development. According to a large number of experimental facts, we first put forward in the world "soil spectrum" of new ideas and new perspectives in the research and development under the guidance of a new product - "diseases of cropspecific type BGA soil conditioner. In the past two years, to address these challenges, the new products do Le some experimental work, and have achieved very good results and theoretical breakthrough of the practical.

3.10.1 陕西省洛川县苹果腐烂病 Apple canker in Luochuan County, Shanxi Province

陕西省洛川县以苹果为其主导产业，覆盖农户 3.75 万，占农户总数的 96%。苹果种植面积 50 万亩，占全县耕地面积的 96%。苹果总产量达 50 万吨，占全国苹果总产量的 2.5%，世界苹果总产量的 0.8%，总产值 8 亿元，农民人均苹果纯收入 3200 元。但是作为世界性难题的苹果腐烂病严重制约着

苹果产业的健康发展，据 2008 年 4 月调查，病园率 69.9% 病株率 10.7%，病情严重的果园病株率高达 27.1%，一直没有有效的根本性的防治办法。

北京绿天使科技有限公司从 2007 年 10 月开始在洛川试验用 BGA 土壤调理剂防治苹果腐烂病，一年来取得明显效果，并且苹果着色和口感有很大改善。

Luochuan County, Shanxi Province takes apple for its leading industry, covering 37,500 households, accounting for 96% of the total households. Apple planting area of 33.33 thousand hectares accounting for 96% of arable land throughout the county. Apple's total output of 500,000 tons, accounting for 2.5% of Apple's total output, 0.8% of world apple production, output value of 800 million yuan, rural per capita net income 3200 yuan Apple. But as global problems of apple rot seriously hindering the healthy development of the apple industry, according to April 2008 survey, 69.9% rate of disease Garden, strain rate of 10.7%, a serious condition orchard strain rate of 27.1%, has not been fundamental and effective prevention.

Beijing Green Angel Technology Co., Ltd. used BGA soil conditioner to cure apple canker in Luochuan since October 2007, and has gained significant effect within one year, the apple color and taste improved a lot.

同一株苹果树，旧的腐烂病尚未治愈（下部），新的病灶又发生（中部）

New focuses occur (middle) before the old canker is cured (bottom) on the same apple tree

常规方法未能阻止这颗苹果树腐烂病的蔓延，病灶越来越大

The conventional method can't prevent the apple tree from the spreading of canker,

2008 年 *7* 月 *15* 日施用 *BGA* 土壤调理剂，一个月后（*9* 月 *16* 日）原病灶区长出很厚的再生皮

On July 15, 2008 BGA Soil Conditioner was applied, and one month later (Sep. 16) the original focus area had thick regenerated bark

我们利用自己研制的“土壤能谱仪”测试了正常生长苹果土壤（健康土）、患腐烂病苹果土壤（病土）和加 BGA 土壤调理剂的患腐烂病苹果土壤（加 BGA 病土）的能谱（以相对能态值表示），用以诊断苹果腐烂病病因和从土壤能量角度观察 BGA 土壤调理剂对苹果腐烂病的治疗作用，测试结果见表 1。

We use the Soil Energy Spectrometer(SES) developed by ourselves to test the energy spectrum of normal soil for apple growth (healthy soil), soil with rot disease (ill soil) and the rot soil with BGA soil conditioner (ill soil with BGA), to examine the reason of rot and to observe the cure function to the disease of BGA soil conditioner. The testing results are in table 1.

表 1 洛川苹果土壤样品相对能态（数字式仪器）测试结果

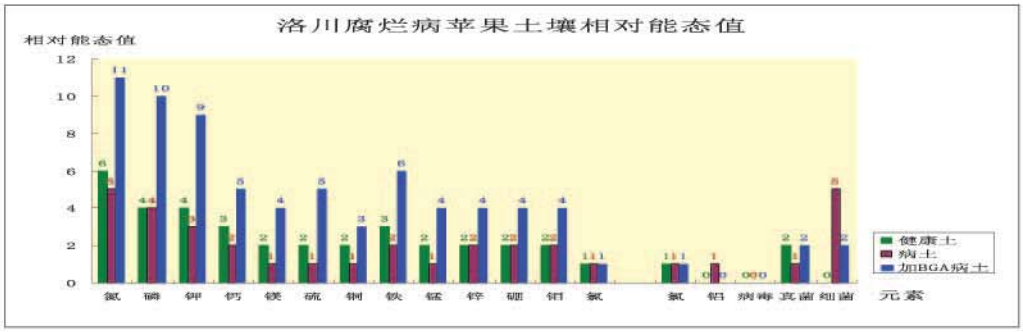
Table 1 Relative value of energy level in apple soil sample (canker) in Luochuan

项目 Item	N	P	K	Ca	Mg	S	Cu	Fe	Mn	Zn	B	Mo
健康土 Health Soil	6	4	4	3	2	2	2	3	2	2	2	2
病土 ill soil	5	4	3	2	1	1	1	2	1	2	2	2
加 BGA 病土 ill soil with BGA	11	10	9	5	4	5	3	6	4	4	4	4

项目 Item	Cl	Al	病毒 Virus	真菌 Fungus	细菌毒素 Germ
健康土 Health Soil	1	0	0	2	0
病土 ill soil	1	1	0	1	5
加 BGA 病土 ill soil with BGA	1	0	0	2	2

为更直观，将表 *1* 数据用柱形图表示：

The data of Table 1 will be shown in histogram to be more direct-viewing:



由表 1 可见，洛川得腐烂病土壤中氮、钾、钙、镁、硫、铜、铁、锰的相对能态值（与土壤营养元素的有效供给正相关）明显低于健康土壤，施用 BGA 土壤调理剂后得到明显改善。而致病原因主要是细菌毒素相对能态值过高，铝的相对能态值偏高也是致病因素。施用专门调配的 BGA 土壤调理剂后致病因子得到纠正，苹果腐烂病也就被治好了。如果致病因子没有得到纠正，我们就调整 BGA 土壤调理剂配方和工艺，直到致病因子得到纠正。根施 BGA 土壤调理剂的同时，我们还采用清除病灶并直接贴敷 BGA 土壤调理剂的办法，收到更好效果。

施用 *BGA* 土壤调理剂的洛川苹果树
Apple trees in Luochuan with BGA soil conditioner

We can see in table 1, the relative value of energy level of N, K, Ca, Mg, S, Cu, Fe, Mn is obviously lower than healthy soil for Luochuan rot soil, and after using BGA, the situation changed a lot. The cause of the disease is mainly the over high relative energy state values of the bacterial toxin, and the slightly high energy state values of aluminum is also the cause of the disease. The causative agent was corrected after the specially prepared BGA soil conditioner was applied, and the canker of apple fruit was cured. If the causative agent had not been corrected, we would adjust the formulae and the process of the BGA soil conditioner until the causative agent is corrected. While BGA soil conditioner is applied to the root, we will clear the focus and directly apply BGA soil conditioner, which has better effect.

3.10.2 河南灵宝的苹果根腐病和大枣枣疯病
Armillariella Root Rot of Apple and Jujube Witches Broom in Lingbao, Henan

土壤能谱分析结果（表 2）表明用 BGA 土壤调理剂使患根腐病苹果树的土壤的有效养分供给得到很大改善，并查明和克服了致病因子：主要是真菌，其次是细菌。原先在这样的地里是栽不活树苗的，施用 BGA 土壤调理剂后能栽活了。

The soil energy spectrum result (Table 2) shows that BGA soil conditioner can substantially improve the effective soil nutrient supply of the trees with armillariella root rot. The causative agent was identified and overcome: fungus and bacteria. Before the young trees were impossible to grow in this kind of field, but they can grow after BGA soil conditioner was applied.

表 2　河南灵宝苹果根腐病土壤样品相对能态（数字式仪器）测试结果
(Digital Instrument) Relative value of energy level in apple soil sample (armillariella root rot) in Lingbao, Henan

项 目 item	N	P	K	Ca	Mg	S	Cu	Fe	Mn	Zn	B	Mo	Cl	Al	病毒 virus	真菌 fungus	细菌 germ
健康土 Healthy soil	4	3	3	2	2	3	2	3	2	2	2	2	2	1	0	1	1
病土 sick soil	5	2	2	1	2	1	1	2	1	1	1	2	1	1	0	5	3
BGA 治理后病土 Soil treated by BGA	11	8	8	3	4	3	3	4	3	3	3	4	2	1	0	2	2

表 3　河南灵宝枣疯病土壤样品相对能态（数字式仪器）测试结果
(Digital Instrument) Relative value of energy level in jujube soil sample (jujube witches broom) in Lingbao, Henan

项 目 item	N	P	K	Ca	Mg	S	Cu	Fe	Mn	Zn	B	Mo	Cl	Al	病毒 virus	真菌 fungus	细菌 germ
健康土 Healthy soil	6	5	6	3	2	2	2	3	2	3	3	2	2	0	1	0	1
病土 sick soil	4	2	2	1	2	1	1	2	1	2	1	2	2	1	4	0	2
BGA 治理后病土 Soil treated by BGA	10	8	8	3	4	3	3	4	3	3	3	4	2	0	2	0	1

土壤能谱分析结果（表 3）表明枣疯病原因与苹果得根腐病的原因是不同的，其主要原因是病毒，其次是细菌；营养元素除镁外相对能态值都偏低，依此配制的 BGA 土壤调理剂在实验室试验对提高土壤营养元素的相对能态值和克服致病因子是有效的。

The soil energy spectrum result (Table 3) shows that the cause of jujube witches broom is different from that of armillariella root rot of apple, with the first fungus and the second bacteria. The nutrients, except Magnesium, have lower relative level of energy state, and BGA soil conditioner prepared accordingly are effectively in improving the relative energy state value of the soil nutrients and overcoming the causative agents.

3.10.3 海南槟榔黄化病
Yellows of areca in Hainan

海南省共种植槟榔 75 万亩，年产值 20 多亿元。是海南省的主要热带经济作物之一，也是琼海市农业三大支柱产业（槟榔、橡胶、胡椒）之一。但是近年来槟榔黄化病肆虐我国海南和东南亚各国，严重制约着槟榔业的发展。海南为此每年损失高达 1.5 亿元。黄化病使槟榔黄叶、烂根、束顶，最后导致死亡，传染性极强。从 1997 年起先后有国内外多所科研院所和大学的专家、教授来海南省琼海市进行多种灭病方法的试验，但到目前为止都收效甚微。还只能将得此病的槟榔砍掉并用火烧以给土壤消毒，阻止其蔓延。因此尽快遏制和根治槟榔黄化病已成为海南农业发展的重大问题之一，它直接关系到数以万计以种植槟榔为主的海南农民的生计。省领导和各级主管部门对此非常关注，农民十分焦急。

为根治槟榔黄化病 2007 年 4 月北京绿天使科技有限公司用最近研制的“病害作物专用型”BGA 土壤调理剂在琼海市嘉积镇温泉村对 10 株已濒临死亡的槟榔树进行了试验，结果 100% 得到恢复：30 天以后观察，黄叶已被控制，开始长出新根；60 天以后开始长出新叶，成树已重新开花结果，本来无望的农民异常兴奋。到目前为止，已有琼海市领导、海南省农业厅领导、中国热带农业科学院的专家及省市有关专家亲临现场考察给予充分的肯定。6 月下旬在农民已废弃的严重病害的槟榔田里扩大了试验：10 亩计 1200 株病树，现在不但长出新根、绿叶，而且有的树开花、结出槟榔果。

There are 50,000 ha areca in Hainan Province. The annual production value is more than 2 billion RMB. It is one of the main tropical cash crop for Hainan province, and one of the three main agricultural industry (areca, rubber and pepper) for Qionghai City. However, in the recent years, the yellows of areca prevails in Hainan province and southeast-Asian countries. It has severely restricted areca industry development. The annual loss for Hainan is nearly 0.15 billion RMB. The yellows makes areca with yellow leaves, rot root, bunchy top and dying eventually. The disease has strong contamination. Since 1997, there have been many experts and professors from various research institutes and universities came to Qionghai City, trying many methods for cure this disease. But up to now, the effects are limited. The only way is cut the trees to burn in order to clear the soil to prevent its spread.

Therefore, restrict and eliminate the yellows of areca is one of the important issue for Hainan agricultural development. It directly involves the life of areca farmers. The provincial level leaders and various level relevant departments take a lot of care. Farmers are anxious.

For eliminate the yellows of areca, Beijing Green Angel Technology Co., Ltd. has developed “diseases crop specific type BGA soil conditioner” in April, 2007, and applied on 10 trees in Wenquan village, Jiaji township, Qionghai City. All trees recovered after 30 days, it is observed that yellow leaves disappeared, new roots developed. After 60 days, new leaves emerged. Matured trees renewed to flowering and fruiting. The farmers were very happy. Up to now, the leaders from Qionghai city, from Agriculture Bureau of Hainan Province, and experts from Chinese Academy of Tropical Agricultural Sciences, and from provincial and municipal level units visited the site for investigation. They affirmed the result. In late June, test was carried on the abandoned dying areca field, about 0.67 ha with 1,200 plants. Nowadays, good results have achieved. And it planed to hold meeting for check and accept and approval at a suitable time.

6 月 27 日所摄被农民废弃得了黄化病的槟榔田，6 月 30 日用 BGA 土壤调理剂治理
Abandoned diseased areca field photographed on June 27, and treated by BGA on June 30

2 个月后 8 月 30 日所摄原来枯黄的树顶都绿了
The formerly yellow tree top had been green photographed on August 30, two month after BGA treatment

正常的槟榔 *Normal areca*

得病和已死亡的槟榔 *Diseased and dying*

2007 年 *4* 月 *24* 日施 *BGA* 土壤调理剂时黑褐色烂根 *Dark brown rot root seen when*

2007 年 *5* 月 *29* 日拍摄所见长出白色的新根 *White new root photographed on May 29*

施 *BGA* 土壤调理剂的病树 *6* 月 *5* 日已长出新 芽 *Newly emerged buds on BGA treated tree on June 5*

8 月 *30* 日海南省农业厅主管副厅长王宏良考察试验基地后说这在世界上是一个突破 *After investigated experiment site on August 30, Mr. Wang Hongliang, deputy director of Agriculture Bureau of Hainan Province said it is a breakthrough in the world*

琼海市梁副市长 *5* 月 *29* 日考察试验现场 *Vice mayor Liang of Qionghai City investigated experiment site on May 29*

专家们在试验现场参观 *Experts visited experiment site*

BGA 土壤调理剂治愈的病树结出槟榔果，摄于 *2009* 年 *4* 月 *2* 日 *Betel nut from the cured trees once illed with BGA soil conditioner, photo was taken Apr. 2, 2009*

表 4 海南槟榔土壤样品相对能态（数字式仪器）测试结果

(Digital Instrument) Relative value of energy level in areca soil sample (areca cathecu) in Henan

项 目 Item	N	P	K	Ca	Mg	S	Cu	Fe	Mn	Zn	B	Mo	Cl	Al	病毒 Virus	真菌 Fungus	细菌 Bacterium
健康土 Health oil	6	6	5	2	2	1	2	3	2	2	3	2	2	0	0	0	0
病土 Disease soil	4	3	3	1	1	1	2	2	1	1	2	1	3	3	3	0	0
BGA 治理后病土 Disease soil aftertreatment with BGA	12	12	11	4	4	3	3	5	4	4	5	4	2	0	1	0	0

由表 4 可见，海南槟榔染黄化病的土壤有效的营养元素的相对能态值明显低于健康土壤，施用 BGA 土壤调理剂后得到明显改善。而致病原因主要是病毒和铝的相对能态值过高，染黄化病的土壤施用专门调配的 BGA 土壤调理剂后致病因子得到纠正，槟榔黄化病也就被治好了。

Table4 shows that the efficient nutrition relative energy level for soil with the yellows of areca was obviously lower than that for healthy soil. But it was improved obviously after BGA application. The reason for disease was higher relative energy level of virus and Al. Factors in soil causing the yellows were improved by special BGA formula. Therefore, the yellows of areca were cured. If disease factors not yet improved, we change the formula until the factors be improved.

3.10.4 广东香蕉巴拿马病 Banana Panama disease in Guangdong

2004 年以来香蕉巴拿马病在主要产蕉国流行，2006 至 2007 年我国广东、海南出现异常严重的灾情。食用“巴拿马”病香蕉致癌的谣言纷纷而起，香蕉价格一落千丈，给蕉农以沉重打击。香蕉“巴拿马”病又叫香蕉镰刀菌枯萎病、香蕉黄叶病，一旦发生很难彻底根除。法国科学家警告，香蕉“巴拿马”病和香蕉叶斑病有可能将所有的种植香蕉的园地夷为平地。台湾生产的香蕉占日本香蕉市场的 70% 以上份额，但现在几乎萎缩殆尽，直接原因就是香蕉“巴拿马”病的发生。本病属土壤性病害，业界公认目前还没有理想的特效药，唯一的办法就是发现零星病株要及时清除销毁。

2007 年 4 月本公司用其最近研制的“病害作物专用型 BGA 土壤调理剂”在广东省番禺市对治疗香蕉“巴拿马”病进行了有益尝试，取得了令人振奋的结果。

Since 2004, banana Panama disease prevailed in main banana production countries. In 2006-2007, Guangdong and Hainan provinces got extremely severe disease spell. The rumor that cancer comes after eating Panama diseased banana spread everywhere, which decreased banana price lower to the least, attacking banana farmers greatly. Banana Panama disease is also called banana Fusarium wilt disease, or banana yellow leaf disease. If once occur, it is difficult to be eliminated. French scientist warned that it is possible that banana Panama disease and banana leaf spot disease will destroy banana plantation to wild land. The banana produced in Taiwan had occupied Japanese banana market more than 70% before. But now, it is hard to find Taiwan banana in Japanese market directly due to banana Panama disease. It belongs to soil disease. It is well known that there is not yet effective medicine. The only way is destroy the erratic diseased plant as soon as possible.

In April, 2007, our company tried to cure banana Panama disease with recently developed "diseases crop specific type BGA soil conditioner" in Panyu city, Guangdong Province, and achieved good result.

得了巴拿马病的香蕉的主茎 *Banana main stem with Panama disease*

得了巴拿马病的香蕉的近地主茎剖面 *Section of banana main stem base with Panama disease*

施用 *BGA* 土壤调理剂 *10* 天后病树长出新根 *New roots appeared after 10 days with specialty BGA"*

施用 *BGA* 土壤调理剂 *15* 天后病树长出新叶 *New leaves appeared after 15 days with "specialty BGA"*

表 5 广东香蕉土壤样品相对能态（数字式仪器）测试结果

(Digital Instrument) Relative value of energy level in banana soil sample (banama) in Guangdong

项目Item	N	P	K	Ca	Mg	S	Cu	Fe	Mn	Zn	B	Mo	Cl	Al	病毒 Virus	真菌 Fungus	细菌 Bacterium
健康土 Health soil	6	6	5	2	2	1	2	3	2	2	3	2	2	0	0	0	0
病土 Disease soil	5	5	6	2	2	2	2	2	3	2	2	1	2	3	5	1	4
BGA土壤调理剂治理后病土 Disease soil aftertreatment with BGA	11	11	12	5	4	4	3	5	5	4	4	3	1	1	2	0	2

由表5可见，广东香蕉巴拿马病的土壤虽然有效的营养元素的相对能态值与健康土壤大致一致，但施用 BGA 土壤调理剂后仍得到明显改善。而致病原因主要是病毒和细菌的相对能态值过高，铝的相对能态值偏高也是一个致病原因。染巴拿马病的土壤施用专门调配的 BGA 土壤调理剂后致病因子得到纠正，巴拿马病也就被治好了。

Seen from Table 5, the relative energy state value of the effective nutrients of the soil with Panama disease in Guangdong is roughly consistent with that of the healthy soil, however, it is significantly improved after BGA soil conditioner was applied. The cause of the disease is mainly the over high relative state values of energy level the viruses and bacterial, and the slightly high energy state values of aluminum is also the cause of the disease. The causative agent was corrected after the specially prepared BGA soil conditioner was applied to the soil with Panama disease, and Panama disease was cured.

3.10.5 山东莱芜姜瘟病和烂脖子病

Blast and neck-corrosion of Ginger in Laiwu, Shandong province

山东莱芜是我国重要的生姜生产和出口基地，近几年姜瘟病和烂脖子病盛行，严重影响了生姜产业的发展。目前尚无好的治疗方法。2007 年本公司用病害作物型 BGA 土壤调理剂试验治疗生姜病害，取得非常好的效果。

左：未使用 *BGA* 土壤调理剂
右：使用 *BGA* 土壤调理剂
Left: without BGA soil conditioner
Right: with BGA soil conditioner

未使用 *BGA* 土壤调理剂的生姜 *Gingers without BGA soil conditioner*

使用 *BGA* 土壤调理剂的生姜 *Gingers with BGA soil conditioner*

表 6 山东生姜姜瘟病土壤样品相对能态（数字式仪器）测试结果

(Digital Instrument) Relative value of energy level in pseudomonas soil sample (epidemic) in Shandong

项 目 Item	N	P	K	Ca	Mg	S	Cu	Fe	Mn	Zn	B	Mo	Cl	Al	病毒 Virus	真菌 Fungus	细菌 Bacterium
健康土 Health soil	6	7	7	4	3	2	4	3	3	3	2	2	1	2	1	0	2
病土 Disease soil	7	4	4	2	1	2	2	2	1	2	1	1	2	3	3	0	6
BGA土壤调理剂治理后病土 Disease soil after treatment with BGA	13	10	10	5	3	4	4	5	3	4	4	3	1	2	1	0	3

由表 6 可见，山东莱芜姜瘟病的土壤除氮和硫外的营养元素相对能态值明显低于健康土壤，施用 BGA 土壤调理剂后得到明显改善，而氮和硫的相对能态值也有较大提高。致病原因主要是细菌毒素，其次是病毒和铝、氯的相对能态值过高，染姜瘟病的土壤施用专门调配的 BGA 土壤调理剂后致病因子得到纠正，姜瘟病也就被治好了，这已被实践证实。

Table 6 shows that the nutrition relative value of energy level for soil with ginger blast disease was obviously lower than that for healthy soil in Laiwu City, Shandong Province, except N and S. The relative value of energy levels was improved by BGA application, even the levels of N and S increased. The causes of disease was mainly bacteria, secondly virus, Al and Cl with higher levels. Soil with ginger blast disease was improved by BGA application, so that ginger blast disease was cured. It is proven by practice.

表 7 山东生姜烂脖子病土壤样品相对能态（数字式仪器）测试结果

(Digital Instrument) Relative value of energy level in pseudomonas soil sample (solanacearum) in Shandong

项 目 Item	N	P	K	Ca	Mg	S	Cu	Fe	Mn	Zn	B	Mo	Cl	Al	病毒 Virus	真菌 Fungus	细菌 Bacterium
健康土 Health soil	6	7	7	4	3	2	4	3	3	3	2	2	1	2	1	0	2
病土 Disease soil	5	4	3	3	2	3	1	1	2	1	1	1	2	1	0	0	5
BGA土壤调理剂治理后病土 Disease soil after reatment with BGA	11	10	9	5	4	5	3	3	4	4	4	3	2	2	0	0	3

由表 7 可见，山东莱芜姜烂脖子病的土壤除硫外的营养元素相对能态值明显低于健康土壤，施用 BGA 土壤调理剂后得到明显改善，而硫的相对能态值也有较大提高。致病原因主要是细菌毒素，染姜烂脖子病的土壤施用专门调配的 BGA 土壤调理剂后致病因子得到纠正，姜烂脖子病也就被治好了。

Table 7 hows that the nutritions relative value of energy level for soil with ginger steeping root disease was obviously lower than that for healthy soil in Laiwu City, Shandong Province, except S. The energy levels were improved by BGA application, even the levels of S increased. The cause of disease was mainly bacteria. Soil with ginger steeping root disease was improved by BGA application, so that the disease was cured.

3.10.6 广东惠州柑桔黄叶病

Citrus fruits yellow leaf sickness in Huizhou Guangdong

据龙门县龙华镇桔子协会会长肖文潮介绍，龙门县现在桔子种植面积 29 万亩，黄树约占三成，其中以新种三、四年的新果树发新梢时转黄严重，正好是有收成就变黄无法生长挂果。自 2007 年开始已有不少果园陆续染病，农户无法只有成片丢荒或砍伐。七、八年的壮年树也出现树体变黄，叶片变小等现象，现在普通产区均出现果树病变情况。

肖会长根据多年种桔经验，认为柑桔黄叶的主要原因是：

1. 农民贪图方便化肥表施，促使果树根部向上生长，根基本上吸收不到地底养分，根在表层，晴怕晒，水怕涝，受天气变化影响大，烂根多；.

2. 滥用农药，过度使用农药。近二年有不少无良商贩让果农在果树上使用化学增甜剂，严重伤害果树；

3. 农药、化肥质量差，在商品利益驱动下好的农药化肥里也往往掺假，过量有害的物质就在此过程中渗入土壤，引起土壤变质，不适合果树的生长；

4. 在果树的多年生长中，土壤成分被吸收后得不到充分的补充，土地越来越贫瘠；

5. 工业发达了，生长环境变恶劣了。

所以，黄叶的治疗一定要从根本，即从土壤开始，从提高果树本身抵抗能力开始，BGA 土壤调理剂就是这样解决问题的。

龙华镇朗背村委会主任邓林胜是惠州市授予的农村实用技术员，种桔子超过 30 年，农历七月试用二年生果树，每棵使用 1 公斤 BGA 土壤调理剂，果树黄梢在一个月内转绿，新根生长良好。部分二年生果树施用 BGA 土壤调理剂 150 ～ 300 克／株，黄叶无变化，但新根生长良好，与未用 BGA 土壤调理剂的黄树对比，效果显著，树身不会继续变黄，叶面光亮，而未用 BGA 土壤调理剂的桔树变黄加剧。邓

林胜认为 BGA 土壤调理剂是他的种植多年以来见过的最好的肥料。

龙华镇龙华葛布村李银，试验地二亩，农历八月用，黄梢得到控制，部分树黄梢转绿，使用 BGA 土壤调理剂的树与没用树区别明显，使用树黄梢有转绿的效果并且叶面光亮。

Xiao Wenchao, director of Longhua Town Orange Association of Longmen County, Longmen County at present has a orange planting area of 290 thousand mu(58 thousand hectares), and the yellow trees account for one third of the organs, where most trees turning yellow are 3 to 4 years after being planted, so they are growing yellow and unable to grow fruit when they are to have harvest. Many orchards have had this kind of disease since 2007, and the peasants had no choice but to lie waste or cut them. For some strong trees aged 7 or 8, the trees turn yellow and the leaves turn small, and at present most of the general production areas have the fruit tree diseases.

Based on many years of experience in planting oranges, Director Xiao thinks the chief causes of chlorotic disorder of orange are:

The peasant apply the chemical fertilizer on the surface for convenience, which makes the roots of the fruit trees grow upward and so the root got nearly no nutrient underground. The root is at the surface, which is not resistant to the sun in the sunshine and flood. They are heavily affected by the weather, so there are many rotten roots.

The pesticides are over-abusive. In recent years, some unscrupulous traders let the fruit peasants apply chemical sweeteners on the fruit trees, which heavily damaged the fruit trees;

The pesticides and fertilizers are of poor quality. Driven by the commercial interest, the good pesticides and chemical fertilizers are in adulteration, so overabundant harmful substances entered the soil in that process, causing the soil deteriorates and to be harmful for the growth of the fruit trees.

The fruit trees grow in many years, during which the soil nutrients can' t be supplemented after being absorbed, so the soil is becoming more and more infertile;

The industry becomes advanced, and the growing environment becomes severe.

So, the chlorotic disorder shall be treated fundamentally, i.e., from the soil and improvement of the fruit tree resistance. BGA soil conditioner solves the problem in this way.

Deng Linsheng, Head of Langbei Village, Longhua Town, is the rural functional technician authorized by Huizhou Municipality. He had grown oranges for more than 30 years. He tried 2-year-old fruit tree in the seventh moon, and 1 kg of BGA soil conditioner was applied for each tree, the yellow perch of the fruit tree turned green in a month, and the new root grew well. 150 ～ 300 per plant grams of BGA soil conditioner were applied to each tree for some 2-year-old fruit trees, the yellow leaves had no change, but the new roots grew well. Compared to the yellow trees without BGA soil conditioner applied, the effect is significant. The body of the trees doesn 't continue to turn yellow, the surface of the leaves were bright, but the orange trees with BGA soil conditioner applied continued to turn yellow. Deng Linsheng thinks BGA soil conditioner is the best fertilizer in his many years of experience of growing trees.

Li Yin, living in Gebu Village, Longhua Town, had two mu of experimental field. He applied BGA soil conditioner in the eighth moon, the yellow perches was controlled, some yellow perches turned green. The trees with BGA soil conditioner had significant difference from the trees without it. The trees with BGA soil conditioner applied had green-turning yellow perches and bright leaf surfaces.

用了 *BGA* 土壤调理剂的桔树
Orange trees with BGA soil conditioner

同一果园没用 *BGA* 土壤调理剂的桔树
Orange trees without BGA soil conditioner in the same orchard

3.10.7 海南省三亚市白沙县 Baisha County, Sanya City, Hainan Province

2009 年初，芙蓉田农场施用 BGA 土壤调理剂对患有胡椒瘟的胡椒进行救治，起死回生，17 天黄叶明显减少并发出新芽，病树再次挂果。而一墙之隔的另一农场未施用 BGA 的胡椒树全部因胡椒瘟而死。

At the beginning of 2009, Furongtian Farm applied BGA soil conditioner to cure the pepper with foot rot of pepper, the dying pepper was brought back to life, the number of the yellow leaves was distinctly reduced in 17 days, new sprouts came up and the sick trees had fruit again. The peppers without BGA soil conditioner died of foot rot of pepper in another neighboring farm.

右：*BGA* 土壤调理剂种植的胡椒叶绿而壮；
左：化肥种植的胡椒叶黄而瘦弱
Right: The pepper planted with BGA soil conditioner is green and strong;
Left: The pepper planted with chemical fertilizer has yellow and weak leaves

印尼官员考察海南 *BGA* 救治的胡椒，见到因施用 *BGA* 两个月后死而复生的胡椒再次挂果而赞叹不已。
The Indonesian officials inspected peppers in Hainan cured by BGA, singing high praise for the dying peppers recovered to life having fruit again two months after BGA was applied

3.11 BGA 叶面肥 BGA foliar fertilizer

BGA 叶面肥是北京绿天使科技有限公司的另一个产品，属于含氨基酸水溶肥料，已获得国家农业部的肥料正式登记证：农肥准字 1606 号。BGA 叶面肥在陕西大荔已经做了多种作物试验：玉米、棉花、冬枣、葡萄、向日葵、芝麻、花生、鸡冠花、辣椒、茄子、芹菜、铁树等等，都取得了非常好的效果。它配合 BGA 土壤调理剂使用效果更佳。

BGA foliar fertilizer is another product of Beijing Green Angel Technology Co. Ltd. It is a kind of Water-soluble fertilizers containing amino-acids, obtained Certificate of Fertilizer Registration of Agriculture Ministry of the People' s Republic of China: NONGFEI ZHUNZI 1606.BGA foliar fertilizer was applied in Dali，Shanxi Province to many crops such as corn, cotton, Chinese jujube, grape, sunflower, sesame, peanut, feather cockscomb, hot pepper, eggplant, celery and sago-plum and so on. These experiments achieved good results.

国家农业部正式登记证
Certificate of Fertilizer Registration of China

盐碱地种棉花：左化肥；右 *BGA* 叶面肥
Cotton on saline soil:chemical fertilizers on the left; BGA foliar fertilizer on the right

同一个大棚里重茬 *4* 年的茄子，左侧施化肥，右侧施 *BGA* 叶面肥
Four yearsrepe-ated planting eggplant on the same plastic tunnel: chemical fertilizer left; BGA foliar fertilizer right side

基施 *BGA* 土壤调理剂和喷施 *BGA* 叶面肥的西芹株高、叶大，用化肥种的西芹株矮，叶小
Celery with chemical fertilization was shorter and leaves were smaller Celery with BGA was taller and leaves were larger

老农右手拿的是不用 *BGA* 的芝麻已枯死，左手扶的是喷 *BGA* 叶面肥并且浇水的芝麻，身体右边是喷液体 *BGA* 但不浇水的芝麻 *Dead sesame plant in the farmer's right hand was not treated by BGA. His left hand held the sesame plant treated by BGA and irrigated. To the right of his body, the sesame plant treated by BGA but without irrigation*

基施 *BGA* 土壤调理剂 *0.75* 公斤 / 株，喷 *BGA* 叶面肥的冬枣果实像葡萄一样成串 *Basal application of BGA soil conditioner 0.75 kg/plt plus sprayed BGA foliar fertilizer. The fruits of Chinese jujube looked like the bundle of grape.*

原来一样的铁树，左边喷 *1* 次 *BGA* 叶面肥 *5* 个月后的对比情况
At beginning the same Sago-plum trees, left: once BGA foliar fertilizer, comparison after 5 months

枣树下种花生左施化肥；右施 *BGA* 叶面肥 *Peanut grown under Jujube tree:chemical fertilizers at left; BGA at right*

2009 年春，四川省广汉市三星堆地区樱桃树得卷叶病，严重影响樱桃的生长、产量及上市时间，3 月下旬当地农民使用 BGA 叶面肥对病害树木进行救治，樱桃卷叶虫病害被治愈，樱桃树生长旺盛，产量增加，并提前上市。

In the spring of 2009, the cherry trees had leaf roll disease in Sanxingdui, Guanghan, Sichuan Province, which had sever impact on the growth, output and time to market. In late March the local peasants treated the sick trees with BGA foliar fertilizer, the leaf roll disease of the cherries were cured after three weeks, the cherry trees grew thickly, the output grew and the cherries went to market in advance.

3.12 BGA 在国外 BGA at abroad

3.12.1 巴林 Bahrain

(1) 国际慈善基金举办的海啸灾区国土重建紧急会议

Urgent Meeting for Country Reconstruction Suffered from Tsunami held by International Charitable Foundation

2004 年 12 月 26 日印度洋海啸后受灾国家的生态重建是一个迫切的世界性难题，在世界慈善组织的香港招标会上本公司中标并决定在巴林进行了试验。

The countries suffered from tsunami at December 26, 2004 faced an urgent world-level difficulty of reconstruction. On the bidding conference held in Hong Kong organized by World Charitable Organization, our company received the bid and tested in Bahrain. Our product brought about a great shock there.

张建民董事长兼总经理（左二）出席国际慈善基金举办的海啸灾区国土重建紧急会议
Chairman of the board and General manager Mr. Zhang Jianmin (the 2ndfrom left) attend the Urgent Meeting for Country Reconstruction Suffered from Tsunami held by International Charitable Foundation

张建民董事长兼总经理在国际慈善基金举办的海啸灾区国土重建紧急会议上发言
Chairman of the board and General manager Mr. Zhang Jianmin spoke at the Urgent Meeting for Country Reconstruction Suffered from Tsunami held by International Charitable Foundation

巴林首相（左三）在官邸（试验处）接见公司张建民董事长兼总经理（左一），右二位是国际发明协会主席居尔雅。
The Prime minister of Bahrain (the 3rd from left) met Mr. Zhang Jianmin, director of board and general manager (1st from left), Mr. Guyand Pireer, Chairman of International Invention Association (the 2ndfrom right) was here.

左：*BGA* 土壤调理剂 右：化肥
Left:BGA soil conditioner, Right: chemical fertilize

左：*BGA* 土壤调理剂 右：化肥
Left: BGA soil conditioner Right: chemical fertilizer

项目 Item	叶片数 number of leaves			径围girth/cm	树高 height/cm
处理 Treatment	施前 before use	施1月后 1 month after use	施2月后 2 month after use	施3月后 3 month after use	施3月后 3 month after use
化肥 (chemical fertilizer)	8.00	8.75	9.50	27.25	173.00
BGA 50g/株(g/plant)	7.50	8.50	9.50	33.00	182.75
BGA100g/株(g/plant)	8.25	9.50	10.5	29.25	202.00
BGA150g/株(g/plant)	8.25	9.00	10.0	33.00	203.25

(3) 公司领导应邀出席马来西亚召开的国际会议 the Manager was invited to attend meetings holding in Malaysia

2007 年 8 月 6 日～ 8 日马来西亚外交部在兰卡威 (Langkawi) 举办了“2007 年第 8 届浮罗交怡国际对话会”，会议的主题是“通过塑造人文资本和能力来消除贫穷”，有 30 多个国家的代表出席了会议，其中有 14 位国家首脑。本公司董事长兼总经理张建民先生作为中国大陆的唯一代表出席了会议，并在会议期间就双边关系和国际合作与马来西亚前首相马哈蒂尔先生进行了亲切交谈，仔细看了张总的产品演示。各国代表对本公司的产品——BGA 土壤调理剂和无功耗有机废弃物消解器产了极大兴趣，纷纷表示订货意向。

On August 6-8, 2007, Foreign Affairs Department of Malaysia Government held the “8th Besjaya International Dialogue 2007” in Langkawi. The subject of the meeting was poverty eradication through human capital development and capacity building. Representatives came from more than 30 countries, among them there were 14 heads of country. Mr. Zhang Jianmin, board director and general manager of our company attended the meeting who was the only representative from China main land. During this meeting, Mr. Zhang talked friendly with former Malaysian Prime Minister Mahathir on bilateral relationship and international cooperation and saw Mr. Zhang’ s demonstration. The representatives of various countries made great interest to the products of our company, including BGA soil conditioner and no work consuming organic litter splitter. They showed their intention to buy.

马来西亚前首相马哈蒂尔在认真观看张建民先生的 *BGA* 土壤调理剂演示试验
Mahathir, the former premier of Malaysia,is looking at the BGA soil conditioner test Mr. Zhang Jianmin carefully.

张建民董事长的出席证
Mr. Zhang’ s representative card

3.12.3 日本 Japan

日本滋贺县做 *BGA* 试验的土壤非常恶劣
The soil conducting BGA experiment in Shiga county, Japan is very bad.

正在劣质土壤上施用 *BGA* 土壤调理剂
Applying BGA soil conditioner on the very bad soil

劣质土壤上用 *BGA* 调理剂种植的南瓜
Pumpkin harvested on the very bad soil applied BGA.

车库水泥地上用 *BGA* 土壤调理剂种植的黄瓜
Cucumber harvested on cement floor in garage applied BGA.

日本用 *BGA* 在大田种植蔬菜非常成功
Vegetable grown with BGA in Japan is very successful.

露天土壤上用 *BGA* 种植的茄子
Eggplant with BGA on open soil.

车库水泥地上用 *BGA* 种植的蔬菜
Vegetables with BGA on cement floor in garage

日本朋友林弘久向访问基地的澳洲、日本和香港朋友介绍 *BGA* 日本应用情况，桌子上的蔬菜是他从日本带来用 *BGA* 种的，已经 *1* 周了仍很新鲜。
Mr. Hayashi Hirohis, a Japanese friend was introducing the application of BGA to visitors from Australia and Hongkong visited the base. The vegetables grown with BGA on table were brought by him from Japan. They looked fresh, although they were picked up a week ago.

3.12.4 韩国 Korea

韩国建国大学试验表明，对寒地型草坪使用 BGA 土壤调理剂的区域发芽速度最快，也比较均匀，发芽后的成长情况也最好。高尔夫球场草地，BGA 土壤调理剂与沙子混合及使用绿肥的区域与对照区相比颜色较深。

The experiment conducted in Konkuk University, Korea showed that cold-type lawn with BGA soil conditioner speeded up the fastest and evener germination and build-up afterward. The plot of turf of Golf yard treated by BGA soil conditioner mixed with sand and the plot of green-manure looked greener than CK.

韩国建国大学草坪种植现场
Lawn Plant Site of Korean Konguk University

韩国建国试验报告
Test Report of Korean Konguk University

3.12.5 泰国 Thailand

BGA 土壤调理剂在泰国做试验已经 6 年了，它优异的性能，博得上至王公贵族、政府官员，下至黎民百姓和农民的广泛赞扬，特别是近年泰国水稻产量连年下滑，人们更认准只有 BGA 才是泰国农业的出路。亚洲头号网球手、泰国青少年的偶像斯里查潘(Paradorn Srichaphan)作为 BGA 在泰国的代言人与他美丽的未婚妻、2005 年环球小姐冠军格勒波娃(Natalie Glebova)于 2010 年 6 月 8 日到本公司北京昌平科研基地参观访问，再次对 BGA 大加赞扬。2010 年 9 月 18 日泰国农业部代表团一行 20 多人将参观考察昌平科研基地。

BGA soil conditioner has been test in Thailand for 6 years, and its excellent performance had gained the broad praise from all levels, such as kings, princes and aristocrats, government officials, common people and farmers, especially with the situation that the rice production decreased year by year in the recent years, people confirm that only BGA can be the way for the agriculture in Thailand.

泰国酸性土壤用 *BGA* 土壤调理剂种植的芝麻
Seasame planted with BGA soil conditioner in acid soil in Thailand.

泰国曼谷用 *BGA* 土壤调理剂种植的南瓜
Pumpkin planted with BGA soil conditioner in Bangkok Thailand.

(2)试验 Experiment

试验地点确定为巴林首相官邸。试验取得完全成功，2007 年这些树已长成 7 米高的大树了。

It was decided in the Urgent Meeting for Country Reconstruction Suffered from Tsunami, the experiment of tree planting with BGA soil conditioner is first done in the Official Residence of the Prime Minister of Bahrain .The experiment was completely success, now these trees are 7 meters high.

本公司技术人员 2005 年 7 月 17 日冒着 43℃高温(地温 62℃)在巴林植树，用 BGA 的全部成活，不用的当天死光。

The technician planted trees with BGA soil conditioner in Bahrain at July 17,2005 .These trees all survived though the air temperature is 43℃and temperature on the earth' s surface is 62℃.Trees without BGA soil conditioner all died at the same day.

种植 *54* 天后(*2005* 年 *9* 月 *9* 日)株高 *1.25* 米，树后站立者为国际发明协会主席居尔雅先生

After 54 days of planting on September 9, 2005, the height of tree was 1.25 m. The gentleman behind the tree was Mr. Guyand Pireer, Chairman of International Invention Association.

种植 *56* 天后(*2005* 年 *9* 月 *11* 日)株高 *1.4* 米，两天长高 *15* 厘米。左为居尔雅先生，右为本公司技术人员

After 56 days of planting on September 11, 2005, the height of tree was 1.4 m. Within 2 days 15 cm had been grown. Mr. Guyand Pireer stood on the left. Technician Mr. Li Jiangong of our company stood on the right.

这是某西方发达国家在同地种植的同样的树虽然用了滴灌设备一年后树高仅约 *40* 厘米

This tree planted at the same place grown by another company from a developed country with drip irrigation system. It was only 40 cm high after planting.

3.12.2 马来西亚 Malaysia

2004 年 9 月在马来西亚斗湖地区，美国推荐美、英、法、荷兰、西班牙等国的 13 家公司(研究所)用化肥和有机肥种植火龙果 21 天后出 1 ～ 2 个芽，同期用 BGA 土壤调理剂种的出 8 个芽。

On September, 2004, in Tawau, Malaysia, the USA recommended the chemical and organic fertilizer products made by 13 companies from USA, UK, France, Holland and Spain to grow fortune firethorn. After 21 days, 1-2 buds appeared for these products treatments, whereas 8 buds appeared for BGA.

(1) 火龙果 Sky scale

用化肥和鸡粪 *10* 天后无甚反应

No response after 10 days applied with chemical fertilizer and chick drop

用 *BGA* 土壤调理剂 *10* 天后发出新叶

New leaf appeared after 10 days applied with BGA

用化肥和鸡粪 *3* 月后高仅为 *0.97* 米 *0.97 m*

After 3 months with chemical fertilizer and chick drop

用 *BGA* 调理剂 *3* 月后高达 *2.2* 米

2.2 m after 3 months with BGA

(2)棕榈 palm

在 3 个月内施用 9 次化肥和有机肥的棕榈长 8 ～片叶，叶小、叶黄，同期仅施 1 次 BGA 土壤调理剂的棕榈长 13 片叶，叶大、叶绿。

Palm trees treated 9 times within 3 months by chemical and organic fertilizer products grew 8 smaller and more yellow leaves, whereas that treated with merely once BGA grew 13 bigger and greener leaves.

泰国曼谷用 *BGA* 土壤调理剂种植的苦瓜
Balsam pear planted with BGA soil conditioner in Bangkok, Thailand.

亚洲头号网球手斯里查潘 *2010* 年 *6* 月 *8* 日来到本公司昌平科研基地，对我公司的产品连挑大拇指，倍加赞扬。
Srichaphan, No. 1 tennis player in Asia, came to the company' s research base in Changping on Jun. 8, 2010, and thumb-up to our products.

斯里查潘（右二）等泰国贵宾在张总陪同下参观基地
Srichaphan (R second) and other distinguished guests are visiting the base accompanied by Mr. Zhang.

BGA 土壤调理剂泰国成果验收会 *2010* 年 *7* 月 *17* 日召开
BGA soil conditioner Thailand achievement check and accept meeting was held on Jul. 17, 2010.

泰国法院检查长（中）、梁士荣先生（左）和张总（右）在 *BGA* 土壤调理剂泰国验收会上合影留念。
The group photo of Attorney General of Thailand Court, (M), Mr. Liang Shirong (L) and President Zhang (R) at inspection and acceptance meeting for soil conditioner.

3.12.6 阿布扎比 Abu Dhabi

根据协议 2009 年 10 月 26 日～ 2010 年 1 月 21 日我们在阿联酋阿布扎比市皇家园林进行了种植试验。种植条件十分恶劣，典型的干旱气候，蒸发量是降水量的 100 倍以上，沙漠加盐碱，盐碱含量极高，pH 值高达 8.9，氯离子的相对能态值为 11。我们在这里成功地种植了粮食、蔬菜、草坪、树木等植物，而参与示范种植投标的其它公司及机构的种子发芽和出苗率极低，个别品种甚至不能发芽。充分证明我们的 BGA 土壤调理剂及其应用技术在恶劣环境、气候条件下能够改良土壤、保水抗旱，能解决和改善沙漠国家的土壤和种植现状，从而为改善阿拉伯国家生存环境提供了一种全新的技术手段，对希望脱离依赖石油经济发展的中东国家有重大意义。社会效益、经济效益和生态效益等方面影响深远。

According to the agreement, from Oct.26, 2009 to Jan. 21, 2010, we implemented plant test in the capital of UAE Abu Dhabi. The plant conditions are bad, typical dry climate, the evaporation is 10 times of precipitation, desert plus saline and alkaline, with high saline and alkaline contain PH up to 8.9, chloridion relative energy state is 11. We succeed in planting cereals, vegetables, lawn, wood etc. and the other companies which participated in demonstrate plant tender had very low plantlet rate, and some even with no plantlet. That sufficiently proves our BGA soil conditioner can adapt to bad environment, and climate, and can improve soil, keep water to resist dry, can solve the soil condition and plantation of desert countries, in addition, it' s an brand new way to improve the living environment for Arab countries, and have great meaning for meddle east countries which depend on crude oil. It has a far-reaching influence to social benefit, economic benefit and environmental benefit.

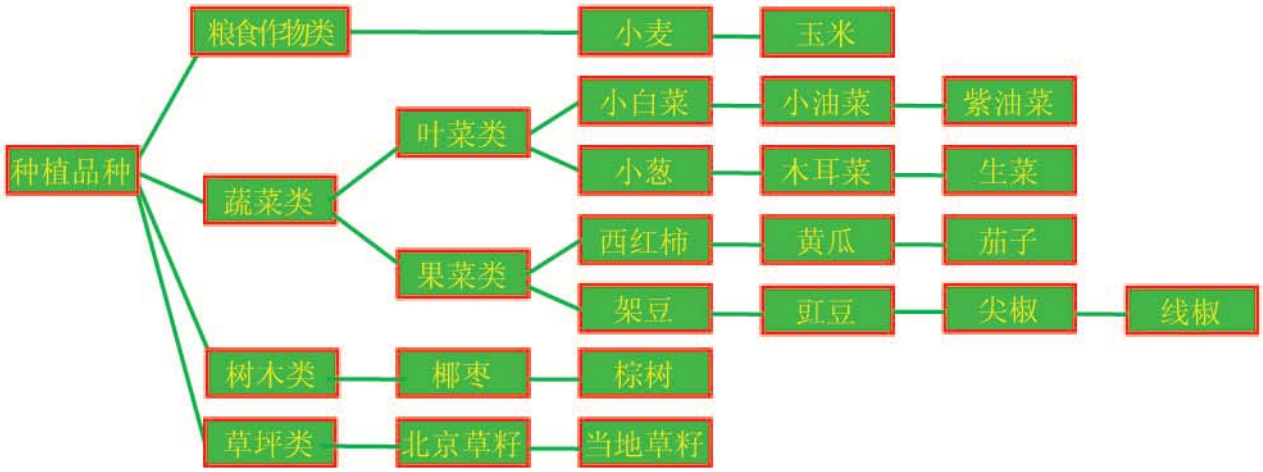
皇家园林公司已经向市政厅汇报了本次示范种植情况，并提出在全市乃至全国推广该技术的建议，希望在阿布扎比种植出更多的优质绿色蔬菜，使沙漠变成绿洲。

Royal Forest Co. had report the demonstrate plant situation to the city hall, and recommended to popularize this technology all over the city even the whole country, wish Abu Dhabi can plant more good quality vegetables, thus turn the desert into oasis.

技术发明人张建民先生给皇家园林公司董事长做产品演示试验
Inventor Zhang Jianmin makes the product presentation test to the chairman of Royal Garden Company.

种植地——盐碱沙漠原貌。当地种植的唯一方法是换土种植，没有在原土直接种植的先例，*BGA* 土壤调理剂就要在原土上直接种植
Plantation–original look of saline-alkali land and desert. The only way to plant was soil replacement. Without the precedents of planting directly in the original soil, BGA soil conditioner was planted directly in the original soil.

种植品种如下：
Types of planting：



种植 *2.5* 个月的小麦已抽穗
The wheat 2.5 months after being planted is in the ear

紫油菜 *purple rape*

豇豆 *cowpea*

青椒 *green pepper*

西红柿 *tomato*

架豆 *two beans*

BGA 土壤调理剂使椰枣树枯黄的叶子(左)变绿了(右)
BGA soil conditioner makes the yellow and dry leaves (left) of date palms turn green (right)

播种 *10* 天后的小白菜对比：
The contrast of pakchoi after 10 days from sowing
远端施 *BGA* 土壤调理剂小白菜正常生长；
Long end fertilize BGA soil conditioner for normal growth of pakchoi
近端施化肥和有机肥的小白菜只有几棵瘦弱的小苗 *Near end fertilize fertilizer and organic fertilizer, the weedy plantlet*

播种 *7* 天后的麦对比：
the contrast after 7 days.
左侧施 *BGA* 土壤调理剂小麦正常生长；
Left side BGA fertilize help normal growth of sweat
右侧施化肥和有机肥的小麦根本没有出苗
Right side fertilizer and organic fertilizer, without plantlet

4 中国科学院和中国工程院院士的指导与帮助
Guide and Help from Academicians of CAS and CAE

2001 年 8 月 21 日北京市科委在北京科学会堂组织科技成果鉴定会。前排为鉴定委员会成员，站立者为北京科委领导，其他专家，来宾和公司员工。前排左起：绿天使公司首任董事长陈英，中国林科院李贻铨研究员，中国农大陈伦寿教授，中国科学院植物所吴兆明研究员，中国科学院院士中国林科院森林生态环境所名誉所长蒋有绪，中国工程院院士中国农科院副院长刘更另，中国科学院阳含熙院士，北京市农委副主任聂玉藻高级农艺师，清华大学核能技术设计研究院副院长郭聚豪研究员，北京市农科院副院长陈航研究员

In August 21, 2001, a scientific achievement approval meeting was held in Beijing Science Hall held by Beijing Science and Technology Committee. The front row sitting were members of Approval Committee. The standing rows were leaders of Beijing Science and Technology Committee, other experts, participators and staff of our company. The front row (from left to right): Ms. Chen Ying, board director of our company; researcher Li Yiquan of Chinese Academy of Forestry Sciences; professor Chen Lunshou of China Agriculture University; researcher Wu Zhaoming of Plant Institute, Chinese Academy of Sciences; academician of Chinese Academy of Sciences and Reputation Director Jiang Youxu of Frostry Eco-environment Institute, Chinese Academy of Forestry Sciences; academician of Chinese Academy of Engineering and Deputy Director of Chinese Academy of Agricultural Sciences Liu Gengling; academician Yang Hanxi of Chinese Academy of Sciences; senior agronomist and Deputy Director Nie Yuzao of Beijing Agriculture Committee; researcher and Deputy Director of Nuclear Energy Design Academy, Qinghua University Guo Juhao; researcher and deputy director of Beijing Academy of Agricultural Sciences ChenHang.

中国科学院刘光鼎院士（右）在海口主持 *BGA* 项目验收会后与张建民先生合影

Mr. Liu Guangding, an academician of China Academy of Sciences Academy, took photo with Mr. Zhang Jianmin after the BGA Project Checking and Acceptance Meeting

中国科学院阳含熙院士（左四）考察基地

Mr. Yang Hanxi (4th from left), an academician of China Academy of Sciences Academy, was investigating in our base

在有中国工程院院士、北京林业大学教授关君蔚（左二）参加的“国家林业局防沙治沙政策技术研讨会”上本公司作了介绍和现场演示试验，*BGA* 土壤调理剂得到充分肯定，左一为中国林科院李贻铨教授。

In Desert Control Policy and Technology Conference, our company introduced and demonstrated the test on site. Professor Mr. Guan Junwei the academician of Chinese Academy of Engineering, (2nd from left) took part in this meeting and affirmed BGA. The gentleman at most lest was Professor Mr. Li Yiquan.

张新时院士（右六）和慈龙骏教授（右五）在基地考察指导

Academician Ph.D Zhang Xinshi (6thfrom right) and Ph.D Ci Longjun (5thfrom right) was investigating in our base.

中国工程院院士、中国农科院原副院长刘更另（右）在基地考察指导

Mr. Liu Gengling, the academician of Chinese Academy of Engineering, was investigating in our base

中国工程院关君蔚院士（中）与国家林业局、中国林科院和本公司人员一道考察怀来境内的沙漠。

Mr. Guan Junwei the academician of Chinese Academy of Engineering, (middle) and personnel of the National Bureau of Forestry, Chinese Academy of Forestry and our company were investigating in the desert in Huailai .

中国科学院院士、欧亚科学院院士张新时（右）和中国林科院原副院长慈龙骏教授在湛江考察 *BGA* 种植桉树

Ph.D Zhang Xinshi (right), an academician of Chinese Academy of Sciences and an academician of Eurasian Academy of Sciences, and Ph.D Ci Longjun, the former vice director of Chinese Academy of Forestry were in Zhanjiang to investigate planting eucalyptus

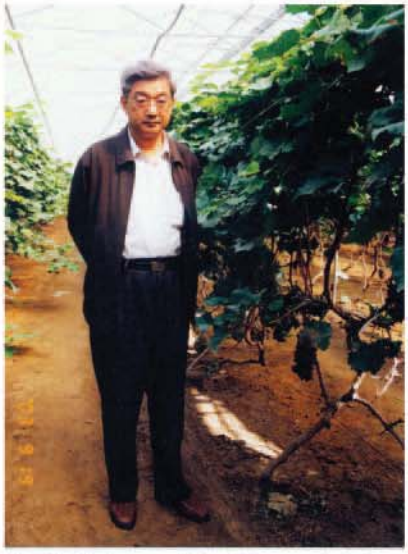
张新时院士(左一)、慈龙骏教授(右三)和国务院参事、中国林科院首席科学家盛炜彤教授等专家们在本公司科研基地考察

Academician Zhang Shixin (first from left), Professor Ci Longjun (third from right) and Professor Sheng Weitong, Chief Scientist of Chinese Academy of Forestry were inspecting the scientific research bases of the company.

5 专家和朋友帮助 Help from experts and friends

公司创建早期召开的项目评估会上的专家们。正面左起：陈伦寿（中国农大教授），周曾铨（北京大学生命学院院长、教授），张建民总经理，王隽英（中国农科院土肥所副研究员），宁国赞（中国农科院土肥所微生物室主任、研究员）；背面左起：周礼（中国农科院农经所研究员），郭聚豪（清华大学核研究院院长、教授），徐和昌（北京化工大学副教授），于建国（中国林科院森林生态所测试中心主任、研究员）

Experts at the project evaluation meeting held in the earlier period of the company' s establishment. From left of front: Chen Lunshou (Professor of of Chin Agricultural University) , Zhou Zengquan (Director and Professor of College of Life Sciences, Peking University), General Manager Zhang Jianmin, Wang Junying (Researcher of Soil & Fertilizer Institute, Chinese Academy of Agricultural Science), Ning Guozan (Director and Researcher of Microbiological Laboratory, Soil & Fertilizer Division, Chinese Academy of Agricultural Science). From left of back: Zhou Li (Agricultural Institute Division, Chinese Academy of Agricultural Science), Guo Juhao (Director and Professor of Nuclear Institute of Tsinghua University), Xu Hechang (Associate Professor of Beijing University of Chemical Technology), Yujianguo (Director and Researcher of Test Center, Forest and Ecology Institute of Chinese Academy of Forestry)



中国农科院土肥所党委书记、国家化肥质检中心（北京）主任梁业森研究员考察基地

Researcher Liang Yesen, Party Secretary of Soil and Fertilizer Institute, CAAS, and director of China National Center for Quality Supervision and Test for Chemical Fertilizers investigated our base

中国林科院首席科学家、原副院长慈龙骏教授（中）在张建民董事长（左）陪同下考察 *BGA* 海南胡椒试验田

Academician Zhang Shixin (first from left), Professor Ci Longjun (third from right) and Professor Sheng Tongwei, Chief Scientist of Chinese Academy of Forestry were inspecting the scientific research bases of the company.

中国热带农科院副院长谢发成研究员（左二）随北京绿天使公司科技小组考察访问摩洛哥农业科研机构

Researcher Xie Facheng (second from left), Deputy Director of Chinese Academy of Tropical Agricultural Sciences, accompanied with Science and Technology Group, Beijing Green Angel Technology Co. Ltd. visited Moroccan agricultural scientific institution

上海王世明量子引力物理研究所所长，“超对称宇宙演化论”原创者王世明教授（左）与张建民总经理亲切交谈

Professor Wang Shiming (left), the originator of Supper Symmetry Universe Evolution Theory and Director of Shanghai Wang Shiming Quantum Gravitation Mechanics Research Institute friendly talked with General Manager Zhang Jianmin

中国林科院李贻铨研究员（右一）陪同美国外宾（右二）参观考察基地

Researcher Li Yiquan (first from right) of Chinese Academy of Forestry was accompanying USA visitor (second from right) visited our base

香港理工大学卢明德教授在陕西大荔考察 *BGA* 种植棉花

Professor Mr. Lu Minde of Hong Kong University of Technology was investigating BGA effect on cotton in Dali, Shaanxi

教授级高级农艺师、农业部司长张世贤(右)考察基地

Professor–level Senio Agronomist, Division Director of Ministry Agriculture Zhang Shixian (right) inspects the base.

李贻铨研究员(左一)、刘立新研究员(左二)、于建国研究员(左三)、梁业森(左四)等专家参加修订企业标准论证会，他们在仔细研读企业标准

Researcher Li Yiquan (first from left), Researcher Liu Lixin (second from left), Researcher Yu Jianguo (fourth from left) and Researcher Liang Yesen attended the feasibility study meeting of modifying the corporate standard. They were carefully studying the corporate standard.

自称为老志愿者的胡溪涛老先生到本公司基地考察，他是北京新四军学会副会长，曾任航空航天部飞机局局长。

Volunteer Mr. Hu Xitao (Vice President of Beijing New 4th army academy, once the Chief of Airplane Branch, Aero-Space Ministry) came to the base for inspection.

中国农科院土肥所刘立新研究员(中)应邀与张建民董事长新疆到考察

Researcher Liu Lixin of Soil and Fertilizer Institute, CAAS was invited to investigate with General Manager Zhang Jianmin in Xinjiang Autonomous Region

北京林业大学招利军博士(右三)在北京门头沟 *BGA* 植树现场测定土壤水分 *Doctor Zhao Lijun (third from right) of Beijing Forestry University checked soil moisture at the site of tree planting in Mentougou, Beijing*

北京林业大学土壤教研室主任孙向阳教授应邀到宁夏论证项目

Professor Sun Xiangyang the Director of soil Department,Beijing Forestry University, earth research center went to Ning Xia to demonstrate the project.

沧州市农科院李学敏研究员（右）与本公司南春波研究员在沧州市农科院 *BGA* 土壤调理剂旱稻试验田里 *Researcher Li Xuemin (right) of Cangzhou Academy of Agricultural Sciences and researcher Nan Chunbo of our company were in high-land rice BGA experiment field in Cangzhou Academy of Agricultural Sciences*

6 国际交流与合作Communication and Cooperation International

6.1 出访 visiting abroad

为拓展 BGA 海外业务，公司人员出访过美国、捷克、日本、泰国、马来西亚、巴林、阿联酋、也门、摩洛哥、南非等国，与国外政要和科学家交流。

In order to promote overseas business, personnel of our company visited USA, Czech, Japan, Malaysia, Bahrain, the United Arab Emirates, Yemen, Morocco and South Africa to meet politicians and scientists.

公司领导(左二、左四)在美国考察时，世界治沙权威 *H.E.Dregene* 博士(左三)盛赞 *BGA* 土壤调理剂剂是世界上最好的治沙产品 *During the leaders of our company (the 2nd and 4th from left) visited USA, Mr. H. E. Dregene (the 3rd from left), a desert control specialist, admired BGA soil conditioner being the best products all over the world.*

张建民先生(右)在也门考察 *Mr. Zhang Jianmin was visiting Yemen*

张建民总经理（右）出访日本时与科学家荒木教授(左)合影 *General Manager Mr. Zhang Jianmin took photo with Japanese scientist Professor Mr. Araki when visiting Japan.*

副总经理南春波研究员（左）在摩洛哥为当地技术人员做 *BGA* 演示实验。*Researcher Nan Chunbo (left), deputy manager of our company was doing BGA demonstration in Morocco*

公司技术人员张建伟（右一）和宋江涛（左二）在泰国指导使用 *BGA* 土壤调理剂 *Technician Zhang Jianwei (first from right) and Song Jiangtao (second from left) were instructing BGA application in Thailand*

由于 BGA 土壤调理剂的优异性能和极显著的使用效果引起了美国、阿根廷、智利、巴西、法国、荷兰、希腊、澳大利亚、日本、印度、马来西亚、韩国、越南、泰国、也门、阿联酋、巴林、摩洛哥等众多国家的官员、科学家、企业家和社会名流的广泛关注，他们纷纷到本公司科研基地参观、考察，寻求合作。

The extremely good properties of BGA soil conditioner and its significant results cause wide attention from scientists of USA, Argentina, Chile, Brazil, France, Holland, Greece, Australia, Japan, India, Malaysia, Korea, Vietnam, Thailand, Yemen, the United Arab Emirates, Bahrain and Morocco. They came to visit our company to see, investigate and look for cooperation.

国际发明协会主席、法国朋友居尔雅（左）考察基地 *Mr. Guyand Pireer, Chairman of International Invention Association. Inspected the base(left)*

朝鲜民主主义共和国人民军的一位将军考察基地 *The general of Korea is inspecting the base.*

美国国家实验室专家丹尼尔•马森来基地参观考察 *Ms. Danielle Mason, specialist in National Laboratory of USA*

全球生态恢复与发展基金会美国总会主席、巴西总统特别顾问 *Mr. Palmari H.de Lucena, the President of American General Association of Global Ecological Restoration and Development Foundation, Special Advisor of Brazil President*

阿联酋外长（右）参观基地 *The minister of Foreign Affairs of the United Arab Emirates (right) was visiting our base*

美国世界级影星尚格云顿 *Jean-Claude Van Damme, the world level movie star of USA visited the base*

6.2 绿天使与联合国 BGA and the United Nations

本公司与联合国有较紧密的接触，联合国各相关部门积极支持 BGA 事业。张建民董事长两次出席联合国可持续发展首脑会议的非政府论坛，他的讲演和演示试验给人们留下深刻印象，并在第 11 届会议上获得联合国颁发的**"全球生态和环境保护杰出成就与贡献奖"**。

Green Angel Co., Ltd. has close relationship with the United Nations. Its various relevant departments support BGA affairs. General director Mr. Zhang Jianmin attended twice the non-governmental forum of Sustainable Development Summit Conference, UN. His speech and demonstration test were impressive, and received the Award of Outstanding Achievement and Contributions to Global Ecology and Environmental Protection.

联合国副秘书长陈健先生(中坐者)在联合国总部十分高兴地题词："绿色天使，造福人类"。
Vice General Secretary Mr. Chen Jian (sitting in center) wrote an inscription in the headquarter of the United Nations as "Green Angel dedicates human"

联合国交流与合作委员会秘书长 *Johnanne Winchester* 女士考察基地 *Ms. Johnanne Winchester, the general secretary of Exchange and Cooperation Committee, UN investigated our base*

2003 年 *9* 月联合国交流合作委员会国际特派员、联合国生态地球联盟主席 *Rob Wheeler* 先生(左二)在公司科研基地参观考察 *Mr. Rob Wheeler (2nd from left), the Special Envoy appointed by Exchange and Cooperation Committee, UN, the President of Ecological Earth Union was visiting and investigating in our base*

联合国防治沙化委员会委员、美国国家沙漠研究所研究员 *David Mouat(* 左二 *)* 参观考察基地 *Mr. David Mouat (2nd from left), the member of Desertification Control Committee, UN, researcher of National Desert Institute, USA was visiting and investigating in our base*

2002 年 *9* 月联合国第十届可持续发展首脑会议非政府论坛(南非约翰内斯堡) *The 10th Non-governmental Forum of Sustainable Development Summit Conference, UN held in Johannesburg, South Africa on September, 2002*

7 媒体报道Media Coverage

《人民日报》、《光明日报》、《万州日报》、《拉萨晚报》、《中国环境》、《绿色中国》、《林业经济》、马来西亚《工商世界》、新疆电视台等新闻媒体，对 BGA 土壤调理剂都有报道。

《People's Daily》、《Guangming Daily》、《Wanzhou Daily》、《Lasa Evening paper》、《China Environment》、《Green China》、《Economy of Forestry》、Malaysia《Industry & Commerce World》、Xinjiang TV etc，had made coverage for BGA soil conditioner.

香港凤凰卫视中文台、资讯台、美洲台、欧洲台 2008 年 11 月 15 日～ 16 日以"天使在人间——唤醒土地生命的绿色奇迹"为题向全世界播出，覆盖区域达 155 个国家和地区，引起极大反响。2009 年 3 月 7 日香港凤凰卫视又一次向全世界播出关于 BGA 土壤调理剂的专题片。

From Nov. 15, 2008 to Nov. 16, 2008, Hong Kong Phoenix Satellite TV, Information TV, America TV, Europe TV in the name of "Date with an Angel--awake the green miracle of land" broadcasted all over the world, covering 155 counties and districts, aroused great repercussions. In March 7, 2009, Hong Kong Phoenix Satellite TV broadcasted the special topic film of BGA soil conditioner again all over the world.

中央电视台第 7 套军事节目——和平年代——优秀复转军人系列节目 2010 年 5 月 27 日播出了《为了脚下的土地》,介绍 BGA 土壤调理剂的发明人张建民先生。

In May 27, 2010, CCTV-7 Military Program broadcasted the program《for the land beneath》--peace era—introducing us the inventor of BGA soil conditioner, an outstanding ex-serviceman, Mr. Zhan Jianmin.


十一届三中全会召
志在大地披绿洲

《人民日报》(海外版)
"People's Dailly"
(Abroad edition)


光明日报
GUANGMING DAILY
治理沙漠有了法宝
北京绿天使公司发明治沙保水型营养剂

《光明日报》2000 年 11 月 17 日
"Guangming Daily" Nov.17, 2000


西藏生菜俏

2001 年 8 月 13 日
Aug. 13, 2001


BGA激活剂轰动约翰内斯堡

《林业经济杂志》
Forest Economy Magazine

《中国环境》
China Enviroment


三个北京妹
三峡创奇迹

《万州日报》Wanzhou Daily


拉萨晚报
10 西藏 综合新闻
5种农产品生产规程
成我区地方标准
藏红花明年即可推广种植
第八届全国藏文

《拉萨晚报》2006 年 9 月 26 日
Lhasa Evening Newspaper Sept. 26, 2006


造福人类的"绿色天使"


绿色中国


唤醒荒漠生命


把好土地留給子孫


绿色中国
和谐社会
我们共同的追求

《绿色中国》2005 年 3 月号
March 2005, Green China


BGA PLAYS KEY ROLE IN RECONSTRUCTIO
REGIONS SUFFERED FROM TSUNAMI
海啸灾区国土重建成难题
中国土壤激活剂大显神威


中國綠色天使
張建民
喚醒荒漠生命

马来西亚《工商世界》2005 年 5 月号
Industrial and Commercal World May 2005, Malaysia

2010 年 5 月 27 日 BGA 土壤调理剂发明人、北京绿天使科技有限公司董事长兼总经理张建民先生应邀去台湾出席“海峡两岸医药生物科技会议”，会议上全国政协副主席何鲁丽女士和台湾立法院院长王金平先生分别亲切地接见了张建民先生。台湾《中央采购公版》当天以“农业技术的革命产品 BGA 土壤调理剂”为题，在头版头条做了相关报道。

On May 27, 2010, Mr. Zhang Jiangmin, inventor of BGA soil conditioner, Chairman and General Manager of Beijing Green Angel Technology Co., Ltd. was invited to Taiwan to attend the "Cross-Strait Medical Biotechnology Conference", Ms. He Luli, Vice-Chairman of CPPCC, and Mr. Wang Jinping, Speaker of Taiwan Legislative Yuan cordially met Mr.Zhang Jianmin in the meeting.


中央採購公報

CENTRAL PROCUREMENT GAZETTE

中華民國九十九年五月二十七日 星期四

蓄水池、下水道用 各式防滑踏步（爬梯）

中華水電冷凍空調設備資訊網 http://www.tpetube.com.tw

農業技術的革命產品 BGA土壤調理劑

貧瘠沙漠之地都能正常生長農作物 北京綠天使科技產品備受肯定

【台北報導】糧食危機的陰霾正逐漸逼近全人類，根據聯合國糧農組織（FAO）2009年6月最新公佈的數字，今年全球飢荒人口將創歷史新高，估計每天約有10億人在挨餓。儘管農業科技界近年致力推行各種提高農作物收成的措施，但是焦點往往只著眼於農作物的收成率，而忽略最基本的一環「土壤」。從事農業種植研究長達12年的北京綠天使科技有限公司技術發明人張建民，已經成功研發出革新的土壤改善技術，甚至能夠在沙漠上耕種，更可令生態環境恢復到原始時期的狀態，因此中國扶貧開發協會特別聘任張建民為愛土工程領導小組技術總監，希望藉由張總監的發明，能讓中國廣大的貧瘠土地都能有好的收成。

在張建民董事長的領導下，北京綠天使科技有限公司開發了多項新農業產品及技術，其中"BGA土壤調理劑"被譽為「農業的技術革命」並通過北京市科學技術成果鑑定委員會的科學成果鑑定，並已獲得國家農業部產品登記。

BGA土壤調理劑其主要功用：1.改良土壤養分，2.逆境條件下提高植物存活率，特別是貧瘠、沙漠之地。3.農作物產量顯著提高。4.改善農、林產品品質。5.促進農作物快速生長。6.保水抗旱功能。7.根治某些農作物的不治之症，例如：檳榔樹的黃化症及香蕉樹的巴拿馬病。BGA土壤調理劑已經在中國全國各地區以及非洲、中東、美國、日本、馬來西亞、印尼等國家成功應用。

張董事長本週特地來台參與「兩岸生技與醫材交流及合作會議」，該會議是由中國大陸全國人大常委會副委員長何魯麗女士擔任榮譽團長，並率領大陸地區生技及醫學專家學者共約150位，與台灣生醫產業互相觀摩交流。張董事長來台期間與台灣的生技業者、農業相關單位，就台灣目前最棘手的問題包括：農作物缺水休耕、農地遭受農藥污染──等等，張董事長非常關心當地農民生計問題，表示這些問題都能利用"BGA土壤調理劑"解決，因為BGA土壤調理劑是從土壤內部來解決問題，台灣農業相關單位對這項產品非常有興趣，張董事長也舉證說明BGA土壤調理劑在世界各地實際成功案例。

公路總局 28日擴大汛期防災演練

何鲁丽副主席(右)与张建民先生(左)
He Luli, Vice-chairman (right) and Mr. Zhang Jianmin (left)

王金平院席(左)与张建民先生(右)
Academician Wang Jinping (left) and Mr. Zhang Jianmin (right)

8 有关BGA土壤调理剂公开发表的部分学术著作和论文
Part of Theory Works and Thesis Public Published about BGA Soil Conditioner

土壤水分及有机肥料对番茄叶片光合特性及叶绿素含量影响的试验研究 《灌溉排水学报》2004 年 02 期 王磊、任树梅、毕勇刚、刘洪禄、吴文勇

结论：①随着土壤水分的增加、番茄叶片的净光合速率、蒸腾速率、气孔导度都有相应的增加趋势．②水分最低的处理反而净光合速率的值较高，是由于在这一处理中，叶片的叶绿素含量较高．③土壤含水率较低的前提下（田持的 40%～ 85%），施加有机肥料 BGA 可以使得番茄叶片的叶绿素含量有较大的增加，平均可增加 13%～ 24%，土壤含水率较高的情况下（田持的 85%～ 100%）叶绿素的含量变化不大．

Manure to the photosynthesis and chlorophyll of tomato in the greenhouse "Effects of Soil Water and Organic "

Wang Lei, Ren Shumei , Bi Yonggang, Liu Honglu ,Wu Wenyong

Conclusion: ①With the increase of soil moisture, the net photosynthetic rate, transpiration rate and stomata conductance of tomato leaf should increase accordingly; ②the lower water treatment result in relatively high net photosynthetic rates, because in this treatment, the chlorophyll content is higher; ③Under the condition with low soil moisture content (40% to 85% field capacity) we can make a greater increase of chlorophyll content in tomato leaves with add organic fertilizer BGA. The average increase is 13% to 24%, while under higher soil moisture circumstances (field capacity 85% to 100%), the chlorophyll content won't change obviously.

有机肥料 BGA 激活剂对日光温室内土壤含水率的影响 《农业工程学报》2005 年 21 期 王磊 ， 任树梅 ， 张文理 ， 毕勇刚 ， 刘洪禄 ，

试验结果表明：BGA 激活剂作为一种有机肥料对于保持土壤水分有着明显的作用，施加 BGA 的土壤含水率要比对照处理高出 17.7%；施加 BGA 后通过水分运移，在根系分布密集的 20 ～ 60 cm之间的土壤含水率较高，其中 20 ～ 40 cm 的土壤含水率增加26%，40 ～ 60 cm 的土壤含水率增加28%；试验研究发现，当 BGA 的施加标准为 150 g/ 株，作物根系土层含水率增加最多．BGA 作为一种有机肥料，为发展节水农业提供了一种新的途径．

Effects of organic manure-BGA on soil moisture content in solar greenhouse Liu Honglu , Wang Lei , Ren Shumei , Zhang Wenli , Bi Yonggang

The experiment results showed that: BGA soil conditioner, as an organic fertilizer for maintaining soil moisture, has obviously helped the maintenance of soil moisture. It can result in 17.7% higher than the control treatment. imposed after the BGA by water flow, root distribution in 20 intensive ~ 60 cm soil water content between the high, in which 20 ~ 40 cm of the soil moisture content increased 26%, 40 ~ 60 cm of the soil moisture content increased by 28%; pilot study found that when the imposed standard BGA 150 g/strains, root crops increased soil moisture content up. BGA as an organic fertilizer for the development of water-saving agriculture provides a new way.

有机抗旱肥料 BGA 的节水机制及其施用技术 《节水灌溉》2006 年 02 期 王勇 ， 杨培岭 ， 任树梅 ， 孟凡奇 ，

BGA 是一种由城乡有机废弃物经资源化处理后制得的有机抗旱肥料，它的推广应用有利于缓减我国水资源紧张和严重环境污染的压力．以 3 年多的试验资料为基础，用 BGA 对大叶黄杨生长、生理过程的影响作为主要阐述对象，结合同类产品的研究成果（如有机肥料），从土壤含水量的变化，植物的生长、光合、蒸腾特性以及水分利用效率等方面，比较系统地总结了 BGA 的节水调控机制．针对不同植物，推荐了 BGA 的施用量和施用方法．

Ways of organic drought-resistance fertilizer BGA "Water-saving mechanism and using" WANG Yong , YANG Pei-lin , REN Shu-mei , MENG Fan-qi

BGA is an organic fertilizers with urban and rural organic waste from the processing by the resources obtained after the drought, promotes the use of its water resources in China is conducive to alleviate the pressure of intense and serious environmental pollution. To 3 years of test data based growth on Euonymus japonicus with BGA, physiological processes of the object as the main set, combined with the research results of similar products (such as organic fertilizer), soil moisture content from changes in plant growth, photosynthesis, transpiration and water use efficiency, etc., systematically summed up the regulatory mechanism of water-saving BGA for different plants, BGA recommended application rate and application methods.

有机抗旱剂 BGA 对大叶黄杨生长及耗水特性的影响 《水土保持学报》2006 年 03 期 王勇 ， 杨培岭 ， 任树梅 ，

结果显示：不论施用 BGA 与否，生长于温室外的大叶黄杨生物量和耗水强度较大，生长于温室内的大叶黄杨生物量和耗水强度较小；温室外大叶黄杨的生物量随 BGA 用量的增加而增加，耗水强度先减小，后增加；温室内大叶黄杨的生物量随 BGA 用量的增加先增加，后减小，耗水强度线性减少；没有施用 BGA 时，温室内外大叶黄杨的 WUE 相近，施用 BGA 后，温室外大叶黄杨的 WUE 大于温室内大叶黄杨的 WUE.

Resistant agent on growth and water consuming of Euonymus japonicus "Impact of organic drought" Wang Yong, Yang Peeling, Ren Shumei

The results showed that: whether application of BGA or not, growth in the greenhouse outside of Euonymus japonicus greater biomass and water consumption intensity, growth of E. japonicus in the greenhouse intensity of small biomass and water consumption; greenhouse biological Euonymus japonicus BGA amount increased with the increase of water consumption intensity first decreased then increased; greenhouse Euonymus japonicus amount of biomass increased with the BGA first increased, then decreased linearly to reduce water consumption intensity; not when applying BGA greenhouse inside and outside the WUE of Euonymus japonicus is similar to applying BGA, the WUE of Euonymus japonicus in greenhouse is bigger than those outside the greenhouse.

水分、抗旱剂 BGA 耦合对大叶黄杨抗寒性的影响 《北京林业大学学报》2006 年 04 期 王勇，杨培岭，任树梅，

用电导法和冻害调查法测定了小区、盆栽大叶黄杨的抗冻害能力随土壤水分和 BGA 用量的变化规律．结果显示：土壤水分、BGA 用量以及它们之间的交互作用对大叶黄杨的抗冻害能力有极显著的影响．当土壤含水量在 60% ～ 75%FC（田间持水量）时，大叶黄杨的抗冻害能力与 BGA 用量的关系为开口向下的二次抛物线关系，其他水分水平，呈线性下降关系；施用BGA时，大叶黄杨的抗冻害能力与土壤含水量的关系亦为开口向下的二次抛物线关系，在 60% ～ 75%FC 时最大．

BGA, a drought resistant agent, on cold resistance of Euonymus japonicus "Coupling effects of soil moisture and " Wang Yong, Yang Peeling, Ren Shumei

Electric conductivity method and the method of cell freezing investigation, anti-freezing capacity of Euonymus japonicus plants with the amount of soil moisture and changes of BGA. The results showed: the soil moisture, BGA consumption and their interaction on Freezing resistance freezing capacity of a very significant impact. When the soil water content at 60% ~ 75% FC (field capacity), the ability of E. japonicus and BGA resistance to frost damage the relationship between the amount for the second parabola opening down, the other water level, a linear decline in relations; application of BGA, the Euonymus japonicus anti-freezing capability and the relationship between soil moisture is also a parabola opening down relationship, 60% ~ 75% FC maximum.

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Ljubljana, 28.2.2017

POROČILO O PRESKUSU ŠT.: 100/2017

Vzorec:	**Organsko gnojilo BGA**
Analitska številka:	**17-100**
Datum prejema vzorca:	**9.1.2017**
Datum izvajanja preskusa:	**od 13.1.2017 do 22.2.2017**

REZULTATI ANALIZE:

Parameter	Enota	V vzorcu
Suha snov (105°C, 4h)	%	62,1
Vlaga	%	37,9
Pepel (žarilni ostanek)	%	11,8
Organska snov (žarilna izguba)	%	50,3
pH v vodi	-	8,3
Dušik – N (skupni)	%	3,38
Od tega N-amonijski (NH_4-N)	%	2,84
Kalij – Kot K_2O (skupni)	%	3,67
Fosfor – kot P_2O_5 (skupni)	%	2,22
Magnezij – Mg (skupni)	%	0,15
Kalcij – Ca (skupni)	%	0,27
Kadmij-Cd	mg/kg	0,03
Svinec-Pb	mg/kg	0,8
Živo srebro-Hg*	mg/kg	<0,10

Opombe: Organska snov je izračunana iz razlike (suha snov - pepel)
*Analiza živega srebra je bila izvedena v laboratoriju NLZOH, Novo mesto
Vzorec ne vsebuje nitratnega dušika. Ima močan vonj po amoniju.

Odgovorni analitik:

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