LAPORAN TAHUN TERAKHIR
PENELITIAN HIBAH BERSAING

KAJIAN PUPUK ORGANIK YANG DIPERKAYA DAN EKSTRAK TANAMAN KAYA UNSUR NITROGEN (N) UNTUK PRODUKSI JAGUNG MANIS BERKUALITAS DAN SERAPAN HARANYA

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FORMULIR EVALUASI ATAS CAPAIAN LUARAN KEGIATAN

Ketua : Dr Ir Darwin H Pangaribuan, M.Sc.

Perguruan Tinggi : Universitas Lampung

Judul : Kajian Pupuk Organik Yang Diperkaya Dan Ekstrak Tanaman Kaya Unsur Nitrogen (N) Untuk Produksi Jagung Manis Berkualitas Dan Serapan Haranya

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Judul Makalah : Growth and yield of sweet corn as affected by paddy straw plant compost and potassium fertilizer
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CAPAIAN LUARAN LAINNYA

TEKNOLOGI TEPAT GUNA

Telah diterapkan kepada Kelompok Tani Aneka Guna di desa Braja Caka, Kabupaten Lampung Timur, dalam program IbM 2016 berjudul Penyuluhan dan Demplot Teknologi Pertanian Organik dengan Demonstrasi Aplikasi Pupuk Organik Cair dan Biopestisida kepada Kelompok Tani di Desa Braja Caka, Kabupaten Lampung Timur berdasarkan Hibah Ipteks bagi Masyarakat (IbM) Tahun Anggaran 2016 Nomor 391/UN26/8/LPPM/2016 tanggal 6 Juni 2016.

Bandar Lampung, 28 Oktober 2016

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DAFTAR ISI

RINGKASAN

Penelitian pada tahun pertama telah dilakukan penelitian pendahuluan. Penelitian ini bertujuan untuk melihat pengaruh aplikasi kompos tandan kosong kelapa sawit dan residunya terhadap pertumbuhan sayuran daun kangkung dan sawi. Penelitian ditata berdasarkan Rancangan Acak Kelompok dengan perlakuan: P1: kontrol (tanah saja), P2: tanah + kompos tandan kelapa sawit 10 t/ha; P3: tanah saja + semprot pupuk organik cair dosis rekomendasi; P4: tanah + kompos tandan kelapa sawit 10 t/ha + semprot pupuk organik cair. Percobaan pertama menggunakan tanaman kangkung. Percobaan kedua menggunakan residu kompos tandan kosong kelapa sawit pada tanaman sawi.Hasil penelitian menunjukkan bahwa pertumbuhan dan produksi kangkung meningkat dengan aplikasi kompos tandan kosong kelapa sawit. Pengaruh residu kompos tandan kosong kelapa sawit juga memberikan pengaruh positif terhadap pertumbuhan sawi.Pemberian kompos tandan kosong kelapa sawit yang dikombinasikan dengan pupuk organik cair efektif memperbaiki pertumbuhan dan meningkatkan produksi sayuran kangkung dan sawi.
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Penelitian tahun kedua bertujuan untuk melihat pengaruh jenis pupuk organik dari limbah tandan kosong kelapa sawit dan jerami padi yang diperkaya dengan kotoran ternak dan dolomit serta interaksinya dengan pupuk Nitrogen (N). Penelitian n dilaksanakan dengan Rancangan Faktorial 4 x 3. Faktor pertama adalah: P1 = pupuk kompos tandan kosong kelapa sawit, dosis 20 ton ha^{-1}; P2 = pupuk kompos tandan kosong kelapa sawit 60% diperkaya pukan ayam 30% dan dolomit 10% , dosis 20 ton ha^{-1}; P3 = pupuk kompos serasah jerami, dosis 20 ton ha^{-1}; P4 = pupuk organik serasah jerami 60% diperkaya pukan ayam 30% dan dolomit 10%, dosis 20 ton ha^{-1}; Faktor Kedua adalah dosis pupuk UreaN0: kontrol; N1: 150 kgha^{-1} (dosis sedang); N2: 300 kgha^{-1} (dosis tinggi). Penelitian kedua tahun pertama telah ditemukan jenis kompos organik yang diperkaya dan interaksinya dengan pupuk Nitrogen, dalam rangka upaya mengurangi penggunaan pupuk anorganik.

Penelitian tahun ketiga bertujuan untuk melihat pengaruh dari limbah jerami padi yang diperkaya dengan kotoran ternak dan dolomit serta interaksinya dengan pupuk Kalium (K). Penelitian dilaksanakan dengan Rancangan Faktorial 2 x 3. Faktor pertama adalah: P1 = pupuk kompos standard jerami padi dosis 20 ton ha^{-1}; P2 = pupuk kompos jerami padi 60% yang diperkaya pukan ayam 30% dan dolomit 10% dosis 20 ton ha^{-1}; Kedua adalah dosis pupuk KCl:K0: kontrol; K1: 100 kgha^{-1} (dosis sedang); K3: 200 kgha^{-1} (dosis tinggi). Penelitian tahun kedua telah ditemukan bahwa pupuk organik jerami yan gdiperkaya berinteraksid deengan pemberian pupuk Kalium. Dosis pupuk Kalium yang direkomendasikan adalakah dosis sedang 100 kg ha^{-1}.

I. PENDAHULUAN

Selama kurun waktu 30 tahun terakhir, paket pertanian modern penggunaan pupuk kimia dan pestisida kimia yang memberikan hasil panen yang tinggi ternyata telah menimbulkan dampak negatif terhadap lingkungan. Aplikasi pupuk kimia memang dapat meningkatkan hasil, tetapi kenaikan harga pupuk yang sering terjadi akhir-akhir ini telah menurunkan daya beli petani. Di samping itu, penggunaan pupuk secara terus menerus tanpa memperhatikan kaidah-kaidah konservasi tanah dan air dapat mengakibatkan tingkat kesuburan tanah menurun, merusak lahan pertanian, serta mencemari lingkungan hidup.Oleh karena itu saat ini perhatian untuk menggali kembali dan melaksanakan praktek pertanian alamiah atau pertanian organik yang mengandalkan sumberdaya lokal semakin besar.

Pertanian organik diartikan sebagai suatu sistem produksi pertanaman yang berazaskan daur ulang hara secara hayati. Daur ulang hara dapat melalui sarana limbah ternak serta limbah tanaman yang mampu memperbaiki status kesuburan tanah. Filosofi yang melandasi pertanian organik adalah mengembangkan prinsip memberi makanan pada tanah yang selanjutnya tanah menyediakan makanan untuk tanaman dan bukan memberi makanan langsung pada tanaman. Dengan kata lain, unsur hara didaur ulang melalui satu atau lebih tahapan bentuk senyawa organik sebelum diserap tanaman (Sutanto, 2002, Acquaah, 2005).

Tujuan penelitian ini adalah merekayasa teknologi pupuk organik yang diperkaya yang meningkatkan efisiensi hara Nitrogen dan menemukan jenis ekstraksi tanaman kaya unsur N yang berpotensi untuk pupuk hayati ramah lingkungan.

Tujuan penelitian ini dilatarbelakangi oleh sebuah urgensi pemikiran sebagai berikut. Harga pupuk kimia semakin mahal sehingga tidak terjangkau oleh petani. Pertanian konvensional yang mengandalkan pupuk anorganik cenderung untuk menguras kesuburan tanah, akibatnya peningkatan produksi mulai sulit dicapai dan bahkan mulai menurun. Hasil penelitian ini diharapkan dapat membantu petani untuk mulai menerapkan pertanian organik sebagai salah satu alternatif sistem pertanian yang berkelanjutan. Lebih jauh lagi, dengan berlakunya AFTA 2020, produk hortikultura Indonesia, termasuk misalnya jagung manis, akan mendapat saingan yang ketat dari produk import dari negara-negara maju. Pertanian organik adalah bentuk pertanian yang ramah lingkungan. Limbah-limbah pertanian dann ekstrak tanaman dapat dimanfaatkan untuk dijadikan masukan organik bagi kebutuhan unsur hara tanaman. Sumberdaya limbah seperti pupuk kandang, limbah jagung, tanaman lamtoro, ekstrak tanaman adalah sumberdaya yang mudah dijumpai oleh petani. Hal ini akan mengurangi ketergantungan petani terhadap masukan kimia seperti pupuk kimia, yang harganya semakin hari semakin mahal. Teknologi pertanian organik yang diusulkan untuk diteliti dan dikembangkan dalam usulan penelitian ini diharapkan akan dapat menguatkan sektor ketahanan pangan.

Penelitian ini adalah sesuai dengan payung penelitian pada *peer group* ilmu tanaman yaitu pengembangan budidaya ramah lingkungan. Dengan demikian pelaksanaan penelitian ini akan banyak dimanfaatkan oleh kolega dalam rumpun bidang ilmu tanaman dan membuka kesempatan juga bagi mahasiswa untuk terlibat dalam penelitian. Road-map penelitian dalam *peer group* telah disepakati bahwa perbaikan eksternal lingkungan tumbuh tanaman dengan masukan minimum dan memanfaatkan sumber daya lokal dikerjakan oleh peer group ilmu tanaman. Produk akhir dari penelitian ini berupa paket teknologi dan jurnal publikasi akan mendongkrak akreditasi program studi Agroteknologi di Universitas Lampung.Iklim ilmiah (s*cientific atmosfer*) yang menunjang kegiatan akademik dengan dihidupkannya penelitian di lapangan dan dilaboratorium akan menjadi manfaat lain dari penelitian ini. Penelitian yang aplikatif sekaligus inovatif ini diharapkan akan mendorong terciptanya suasana kondusif tersebut dalam institusi kami.

1.1. Luaran Penelitian

1. Produk teknologi ekonomis yang ramah lingkungan sebagai masukan organik jagung manis berbasis kompos organik dan ekstrak tanaman diakhir tahun ke tiga.

2. Satu buah artikel dalam Seminar Internasional yang akan dimuat dalam *Acta Horticulturae* penerbit ISHS (www.ishs.org) di akhir tahun kedua
3. Satu buah jurnal nasional di akhir tahun ketiga.
4. Percepatan kelulusan mahasiswa dalam bentuk 3 skripsi mahasiswa program sarjana tahun pertama, 3 skripsi mahasiswa tahun kedua, dan 3 skripsi mahasiswa tahun ketiga.

II. STUDI PUSTAKA

2.1 Hasil-hasil Penelitian Pendahuluan

Penelitian pendahuluan tentang *Reuse dan Recycle* bahan organik tanaman sebagai residu *in situ* pada komoditi sayuran telah berhasil dicoba oleh peneliti utama. Hasil penelitian Pangaribuan (2011) pemberian bokashi serasah tanaman seperti bokashi lamtoro, bokashi daun jati, dan bokashi jerami padi dengan dosis 20 ton/ha dapat meningkatkan pertumbuhan dan produksi tomat dibandingkan dengan pupuk anorganik rekomendasi. Pada penelitian di atas, kompos organik bokashi belum diperkaya dengan campuran bahan organik lain. Selanjutnya oleh peneliti yang sama dicobakan memperkaya kandungan kompos sehingga kualitas komposnya meningkat dan produksi tanaman meningkat. Penelitian Pangaribuan dan Murni (2011) dalam pencampuran dua jenis bahan organik yaitu pupuk kandang ayam dan pukan sapi meningkatkan produksi sayuran tomat. Sampai sejauh ini, teknologi dan publikasi tentang kombinasi yang tepat dari komposisi campuran bahan organik masih sedikit, sehingga perlu dicoba kualitas kompos prima berbasis bahan serasah tanaman yang dapat di *Reuse dan Recycle* pada tanaman jagung manis.

Beberapa hasil penelitian bahan organik pada jagung manis telah dilakukan oleh beberapa peneliti seperti Martajaya *et al.* (2010) yang menunjukkan hasiltongkol segar jagung manis tertinggi diperoleh pada perlakuan *Tithonia diverisifolia,* pupuk kotoran sapi yang diberikan seminggu sebelum tanam. Kemudian peneliti Sastro dan Lestari (2011)menemukan bahwa kotoran cair sapidapat meningkatkan efisiensi relatif agronomis jagung manis. Walaupun hasil penelitian menunjukkan bahwa aplikasi bahan organik menunjukkan hasil yang positif pada jagung manis, akan tetapi penelitian-penelitian yang telah diuraikan di atas dilakukan pada satu musim tanam saja, sehingga belum layak dikirimkan kepada sebuah jurnal internaisonal yang mensyaratkan agar penelitian lapangan dikonfirmasi dengan penelitian selama minimal dua tahun berturut-turut. Sehingga dalam penelitian ini akan dilakukan dua kali pada dua tahun yang berbeda sehingga hasil penelitian tahun pertama akan dikonfirmasi pada penelitian tahun kedua untuk dilihat konsistensi hasilnya.

2.2 State of the Art Bahan Organik pada Jagung Manis

Fungsi bahan organik menurut Hanafiah (2005), Suntoro (2003), dan Winarso (2005)adalah (1) memperbaiki struktur tanah, (2) menambah ketersediaan unsur N, P dan S, (3) meningkatkan kemampuan tanah mengikat air (4) memperbesar kapasitas tukar kation (KTK) dan (5) mengaktitkan mikroorganisme. Beberapa penelitian menunjukkan bahwa pemberian bahan organik dan pemberian pupuk anorganik dapat meningkatkanpH tanah, N-total, P-tersedia dan K-tersedia di dalam tanah, kadar dan serapan hara N, P, dan K tanaman, dan meningkatkan produksi tanaman jagung (Banuwa *et al.* 2003; Djuniwati *et al*., 2003; Rachman *et al*. 2010).

Peneliti Sastro dan Lestari (2011) dalam percobaan pot menemukan bahwa kotoran cair sapi dengan perbandingan urine : air 2:1 dapat meningkatkan efisiensi relatif agronomis jagung manis. Peneliti Martajaya *et al.*(2010) menunjukkan hasil tongkol segar jagung manis tertinggi diperoleh pada perlakuan *Tithonia diverisifolia* atau pupuk kotoran sapi yang diberikan seminggu sebelum tanam. Peneliti Mayadewi (2007) menunjukkan bahwa pupuk kandang ayam 20 ton ha^{-1} memberikan hasil tongkol jagung manis lebih tinggi daripada pupuk kandang sapi atau kambing. Lebih jauh Russo dan Taylor (2010)menyatakan bahwa aplikasi pupuk kandang pada jagung manis meningkatkan hasil yang lebih tinggi daripada hanya aplikasi pupuk anorganik.

Penelitian Iqbal *et al*. (2010) memperlihatkan bahwa kompos sampah kota yang diperkaya dengan anorganik additive berupa rock phosphate dan kapur dapat meningkatkan kualitas kompos dengan cara menurunkan nisbah C:N. Hasil positif aplikasi kompos sampah kota yang diberikan berulang selama 3 tahun pada produksi tanaman blueberry juga ditunjukkan dalam penelitian Warman *et al*. (2009). Tanaman yang di *Recycle* akan memberikan manfaat positif pada musim tanam berikutnya seperti ditunjukkan oleh hasil penelitian jagung manis oleh Dyck *et al*.(1995). Peneliti tersebut menunjukkan bahwa aplikasi pupuk hijau leguminosae akan mengurangi penggunaan pupuk sintetik pada pertanaman jagung manis musim tanam berikutnya. Kompos sampah kota adalah sumber P yang bagus untuk pertanaman jagung manis (Mkhabela dan Warman, 2005). Peneliti yang sama menyatakan bahwa untuk memperkaya ketersediaan N bagi tanaman maka aplikasi kompos perlu ditambahkan dengan dengan pupuk N. Kandungan logam berat pada kompos sampah kota menurut penelitian Perez *et al*. (2007) masih dalam batas toleransi sehingga tidak berpengaruh nyata terhadap kualitas jagung manis dan kondisi kimia tanah percobaan.

2.3 State of the Art Pemupukan Nitrogen dan Serapan Nitrogen pada Jagung Manis

Belum tersedia banyak publikasi pada jurnal nasional maupun jurnal internasional tentang serapan hara Nitrogen komoditi jagung manis sebagai dampak pemberian kompos organik dan ekstrak tanaman. Beberapa penelitian serapan hara Nitrogen pada jagung seperti oleh Rachman *et al*. (2010) menunjukkan bahwa serapan N terbesar pada perlakuan bahan organik 20 tonha^{-1} daripada kontrol. Selanjutnya mereka menyatakan bahwa serapan N P K jagung berkisar 31.41-39.39 kg *Nha*$^{-1}$*,*6.03-12.54 kg Pha^{-1}, 37.5-41.70 kg Kha$^{-1.}$ Peneliti Heckman (2007) juga menunjukkan bahwa serapan hara pada jagung manistidak jauh berbeda dari standard oleh Knott's Vegetable Growersyaitu sekitar (dalam lb/acre) 51 N, 9.1 P, 34 K (atau N setara dengan 57.303 kg ha$^{-1,}$ P setara dengan 10.22 kg ha^{-1}, K setara dengan 38.202 kg.ha^{-1}). Hubungan antara produksi dengan konsentrasi N di dalam daun tanaman jagung manis dielaborasi oleh Heckman *et al*.(2002b)yaitu: < 11 g.kg^{-1} adalah defisiensi dan kurang pupuk N, N antara 11 – 16.5 g.kg^{-1} adalah defisiensi marjinal, antara 16.5 – 21 g.kg^{-1} adalah optimum, konsentrasi > 21 g.kg^{-1} adalah diatas optimum dan kelebihan pupuk N. Sementara itu hasil penelitian Mullins *et al*.(1999) pada beberapa kultivar jagung manis terseleksi menunjukkan bahwa pemupukan N dosis 100 lb/acre (setara dengan 112.36 kg ha^{-1}) menghasilkan produksi jagung manis yang optimum. Semakin tinggi pupuk N diberikan maka tanaman semakin tinggi dan tongkol semakain besar.

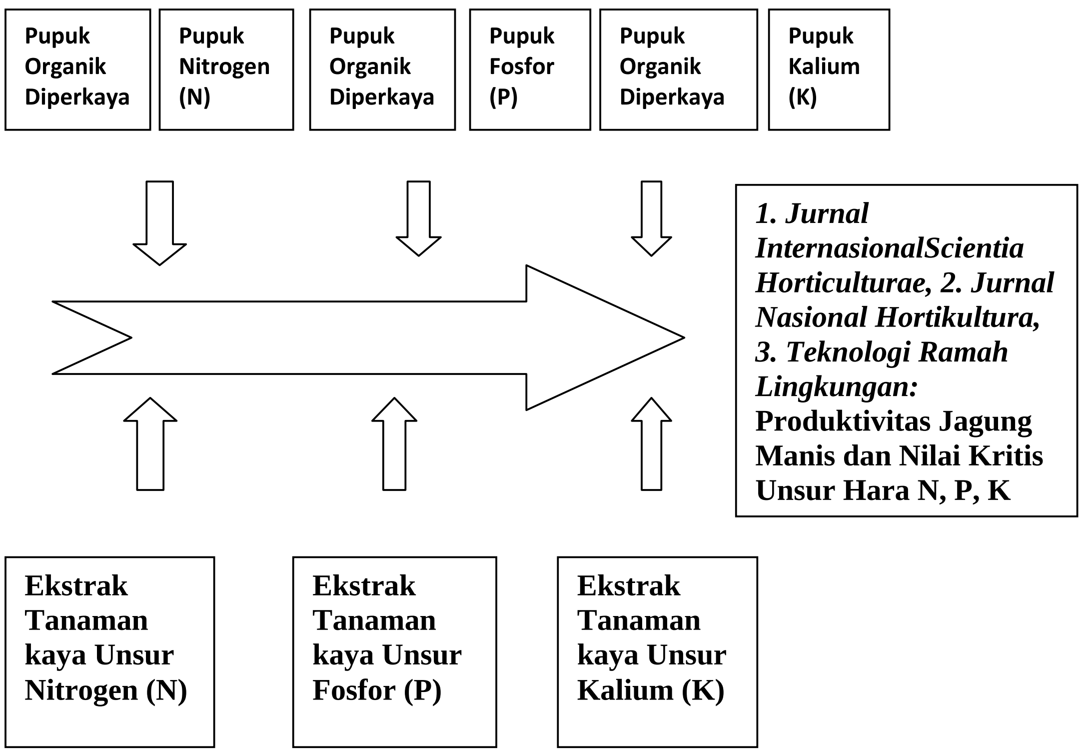
Penelitian Heckman *et al*.(2002a)menyatakan bahwa residu jagung yang dibenamkan dalam pengolahan tanah akan menyumbangkan unsur hara Nitrogen yangsignifikan bagi pertanaman berikutnya. Hal ini berarti bahan organik yangdi *recycle* dari pertanaman sebelumnya akan memberikan kontribusi unsur hara alamiah yang sangat berarti. Aplikasi pupuk N anorganik akan meningkatan hasil jagung manis sampai 50% Cline dan Silvermail (2002). Sementara itu pada komoditi bayam, ditemukan bahwa kombinasi terbaik untuk menghasilkan produksi bayam maksimum adalah kompos 3 t ha^{-1} dengan pupuk N 30 kg ha^{-1}(Akanbi dan Togun 2002). Sampai saat ini belum diketahui berapa kombinasi optimum kompos dan pupuk Nitrogen pada komoditi jagung manis.

2.4 State of the Art Ekstrak Tanaman Kaya unsur N (Nitrogen)

Informasi dan publikasi tentang manfaat ekstrak tanaman bagi peningkatan hasil dan kualitas hasil tanaman jagung manis masih sangat kurang. Larutan MOL (Mikro Organisme Lokal) adalah larutan hasil fermentasi yang berbahan dasar dari berbagai sumber daya yang tersedia setempat baik dari tumbuhan maupun hewan.Menurut Santosa (2008) bahwa mikororganisme lokal (MOL) merupakan salah satu pupuk organik cair yang berwawasan lingkungan dan pemberdayaan kearifan lokal yang berfungsi sebagai pupuk/biofertiliser yang mengandung unsur hara makro dan mikro, serta bakteri perombak bahan organik serta dapat meningkatkan komponen hasil tanaman. Larutan MOL mengandung unsur hara mikro dan makro dan juga mengandung bakteri yang berpotensi sebagai perombak bahan organik dalam tanah, perangsang pertumbuhan pada tanaman, dan sebagai agens pengendali hama dan penyakit tanaman.

Ekstrak tanaman hakekatnya adalah sebuah pupuk hayati. Manfaat pupuk hayati adalah sebagai berikut: (1) menyediakan sumber hara tanaman, (2) melindungi akar dari gangguan ham dan penyakit, (3) menstimulir sistem perakaran agar berkembang sempurna sehingga memperpanjang usia akar (4) memacu mitosis jaringan meristem pada titik tumbuh pucuk, kuncup bunga dan stolon, (5) sebagai penawar racun berbagai logam berat, (6) sebagai metabolit pengatur tumbuh, dan (7) sebagai bioaktivator Saraswati (2000). Peneliti Palimbungan *et al*. (2006) menemukan bahwa aplikasi pupuk cair daun lamtoro dengan dosis 250 cc/liter air dapat meningkatkan pertumbuhan dan produksi sawi. Penelitian Sastro dan Lestari (2011) menunjukkan bahwa pupuk cairan urine sapi yangdilarutkan dengan air dengan perbandingan 1:2 memberikan hasil jagung manis yang terbaik. Penelitian Setianingsih (2009) menunjukkan bahwa aplikasi MOL Rebung Bambu, MOL Maja, MOL Bonggol Pisang, MOL Cebreng dapat meningkatkan junlah anakan dan berat gabah kering giling tanaman padi.

2.5 Road Map Penelitian



III. PUBLIKASI HASIL PENELITIAN

3a. The effect of enriched compost and nitrogen fertilizer on the growth and yield of sweet corn (Zea mays L.)

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Abstract

The integrated use of enriched plant compost and nitrogen fertilizersare one of the main considerations in improving sweet corn productivity in the tropics. **Experiment was conducted to determine the effects of enriched compost and nitrogen fertilizer on the growth, yield and mineral nutrients uptake of sweet corn. The treatments involved two enriched compost (rice straw and empty fruit bunches of oil palm each 20 t ha^{-1})) subjected to three levels of nitrogen fertilizer (0, 75, 150 kg N ha^{-1}). The 6 treatment combinations were laid out in a factorial experiment and fitted into a complete randomized block design with three replication. Compost was enriched by adding chicken manure and dolomite. Growth parameters, nutrient uptake and yield attributes were assessed.** ***Result of experiment showed that enriched rice straw compost showed better vegetative and yield than enrichedoil palm empty fruit bunch compost. The application of full recommended nitrogen fertilizers had the higher yield as compared with other treatments. This implied that the use of enriched rice straw compost and recommended nitrogen fertilizers could be advisable to be applied for the small scale agriculture cultivation in the red acid Ultisol soil.***

Key words: rice straw compost,oil palm empty fruit bunch compost, Urea, ear quality, nutrient uptake

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INTRODUCTION

To maintain soil fertility, agricultural waste must be returned to the soil in the form of compost. The use of compost as a natural fertilizer has increased lately, especially with the development of organic agriculture and the increasing demand for organic food. Types of basic materials for compost abundant around the agricultural community in tropical regions arerice straw and oil palm empty fruit bunch.

The palm oil industry generates an abundance of oil palm biomass such as empty fruit bunch. Processing and utilization empty fruit bunchesby palm oil mill is still very limited. In addition to that, processing and utilization of rice straw is still also very rare. After the harvest is completed, the farmers are burning rice straw.

Oil palm empty fruit bunches contains various macro and micro nutrients essential for plant growth, among others : 42.8 % C ; 2.9 % K2O ; 0.8 % N ; 0.22 % P2O5 ; 0.30 % MgO , 23 ppm Cu and 51 ppm Zn (Singh et al. , 1989). Rice straw is a rich source of organic fertilizer nutrients. Rice straw consists ofSi (4-7%), K (1,2 -1,7%), N (0,5-0,8%) dan P (0,07-0,12) (Dobermann dan Fairhurst, 2000).

According to Palm et al. (2001) application of organic matter play a critical role in both of short-term nutrient availability and longterm maintenance of soil organic matter in farming systems in tropical agro ecosystems. This experiment used the basic ingredients of empty fruit bunches of oil palm and rice straw which have been enriched with chicken manure and dolomite,so that each becomes the enriched oil palm empty fruit bunches compost (EOPEFBC) and enrichedrice straw compost (ERSC). Composted organic material from plants will more quickly decompose when coupled with enrichment materials. Enriched compost will increase soil fertility and improve the productivity of sweet corn.

Nutrients nitrogen, phosphorus and potassium are a major limiting factor in the productivity of sweet corn. Sweet corn response to nitrogen is influenced by several factors such as the use of organic materials. Organic material is the key to improving the productivity of soil and fertilizer efficiency (Barker, 2010). The objective of the experiment is to study the effects of enriched compost and nitrogen fertilizer on the growth, yield and mineral nutrients uptake of sweet corn.

MATERIALS AND METHODS

A field study was conducted at the farmer field, Kota Sepang, Bandar Lampung, Indonesia. The experiment was factorial design within Randomized Complete Block Design (RCBD) with three replication. The treatments consist of two type of enriched compost i.e. enriched rice straw compost and enriched oil palm emptyfruitbunches compost combined each 20 t $ha^{-1}$with three nitrogen levels i.e.N0 = 0 kg N ha^{-1}; N1 = 75 kg N ha^{-1}; N2 = 150 kg N ha^{-1} (recommended dose).

Enriched compost was prepared from oil palm empty fruit bunch (60%) or rice straw (60%), chicken manure (30%), dolomite (10%), rice bran, crushed paddy husk, and fermented EM solution (5 mL of EM + 10 ml molasse + 1985 mL of dechlorinated water and mixed solution was kept at room temperature to ferment for 3 days). Compost was mixed and sprayed with fermented EM solution until the moisture content of compost reach to 50%. After 14-21 days the fermented compost was ready to be used.

Sweet corn hybrid ("Jambore") was used in this study. The plant distance was 70 cm x 20 cm, and block treatment was 3 m x 3 m. N, P and K were applied in the form of Urea, SP36and KCL respectively. The entire quantity of P_2O_5 (75 kg ha^{-1}) and K_2O (50 kg ha^{-1}) was applied as basal at the time of sowing and N was applied in three splits, as basal, at knee-high and tasseling stages.

The study was conducted on Ultisols. Soil and compost were analyzed at Soil and Plant Laboratory, Lampung University. The soil characteristics of the experimental site werepH (6,23), organic matter (1,45%), N total 0,15%, available P 5,31 ppm, available K 19,70 ppm.The soil is loamy soil in texture.The chemical characteristics of ERSC were pH 8,18, C-Organic 25,33 %, N-tot 1,69%, P-tot 0,08%, K-tot 0,88%, Ca : 2.15%,and Mg 0.40%;whereas the chemical characteristics of EOPEFBC were pH 7,51, C-Organic 16,66 %, N-tot 1,87%, P-tot 0,47%, K-tot 1,62%, Ca 1.95%,and Mg 0.30%.

All the recommended cultural practices were used for the management of the experiment. There was no serious incidence of pests and diseases or nutrient deficiencies. Fields were kept weed free by hand weeding at 20–25 day intervals. The observations plant height, number of leaves, brix, length of ear, diameter of ear, ear weight with and without husk, production, chlorophyll content (by Model SPAD 502, Minolta, Japan), the uptake of N, P, Kfrom leaf were recorded. The collected data was analyzed statistically by using Fisher's analysis of variance technique and individual treatment means were separated by using least significant difference (LSD) test at 5 percent probability level.

RESULTS AND DISCUSSION

The interaction effect between types of enriched compost and levels of nitrogen was found non-significant on all parameters observed. Data presented on the main effect of each factor.

The application of enriched compost and nitrogen fertilizers had significant effect on the mean plant height and chlorophyll content (Table 1). However, there was no significant differences on the number of leaves. Enriched rice straw compost (ERSC) showed higher significantly differences over enriched oil palm empty fruit bunch compost (EOPEFBC). This showed that enriched straw compost used promotes the vegetative growth of sweet corn. This finding is similar to that of other researcher who reported better vegetative growth of paddy rice (Barus, 2012) with rice straw compost addition. This confirmed the role of ERSC in promoting vigorous vegetative growth in sweet corn.

The chlorophyll content is an estimate of the N status. The significantly higher chlorophyll content of ERSC treatment than EOPEFBC could be due to differences in nitrogen uptake (Table 4). The greater chlorophyll values in sweet corn leaves is of importance because photosynthetic activity and crop yield may increase with increased chlorophyll content of leaves (Ofosu-Anim and Leitch, 2009).

Table 1. Effects of application of enriched compost and different nitrogen fertilizers rates on vegetative growth of sweet corn

Treatment	Height (cm)	Numberof leaves	Chlorophyll content (SPAD)
Enriched ricestraw compost	234.91 a	12.87	53.39 a
Empty fruit bunch compost	219.98 b	12.51	49.38 b
LSD	8.74	ns	2.16
N 0 kg ha^{-1}	214.00 a	12.53	48.56 a
N 75 kg ha^{-1}	231.07 b	13.05	51.84 b
N 150 kg ha^{-1}	237.27 b	12.50	53.76 b
LSD	10.70	ns	2.65

There are no statistical differences among the treatments having the same letter at 0.05 level according to LSD test. ns = not significant

The growth vegetative parameters (height and chlorophyll content) increased significantly as the nitrogen rate increased from 0 to 150 kg ha^{-1}. This is due to enhanced availability of nitrogen in the soil which increased leaf area, and consequently resulting in higher photo assimilates and in more dry matter accumulation. These results are supported by the findings of Mullins et al. (1999).

There were significant effects of different enriched compost treatments on ear quality (Table 2) yield and yield attributes (Table 3) of sweet corn. With exception for ear length, application of ERSC significantly improved ear diameter, ear weight with husk, ear weight without husk, soluble solid (Table 2), dry weight matter, yield, harvest index with and without husk of sweet corn (Table 3).

The higher dry weight of nitrogen treated plants (Table 3) could be connected with the positive effect of nitrogen in some important physiological processes such as promoting shoot growth and protein synthesis (Barker, 2010) . On the other hand Squire (1990) established that the main effect of N fertilizer is to increase the rate of leaf expansion, leading to increased interception of daily solar radiation by canopy. Better crop growth and development observed under N recommended dose (150 kg ha^{-1}) suggest that increasing crop fertilization to an optimum rate enables the plants to produce their potential vegetative and generative growth, and consequently enhance plant photosynthetic activities and hence more dry matter is produced (Akanbi and Togun, 2002).

Table 2. Effects of application of enriched compost and different nitrogen fertilizers rates on ear components of sweet corn

Treatment	Ear diameter (cm)	Ear length (cm)	Ear weight with husk (kg)	Ear weight without husk (kg)	Soluble solid (^{0}Brix)
Enriched ricestraw compost	4.80 a	17.88	0.38 a	0.30 a	14.30 a
Enriched empty fruit bunch compost	4.46 b	16.82	0.32 b	0.26 b	13.21 b
LSD	0.07	ns	0.04	0.02	0.27
N0 kg ha^{-1}	4.52 a	16.90	0.32	0.26 a	12.63 a
N 75 kg ha^{-1}	4.61 b	17.19	0.36	0.29 ab	13.70 b
N 150 kg ha^{-1}	4.76 c	17.79	0.38	0.30 b	14.93 c
LSD	0.09	ns	ns	0.03	0.33

There are no statistical differences among the treatments having the same letters at 0.05 level according to LSD test. ns = not significant

Table 3. Effects of application of enriched compost and different nitrogen fertilizers rates on yield and harvest index of sweet corn

Treatment	Dry weight matter (g)	Production (ton ha^{-1})	Harvest index with husk	Harvest index without husk
Enriched ricestraw compost	135.00 a	15.03a	0.35a	0.30 a
Empty fruit bunch compost	126.33 b	10.04b	0.32b	0.28 b
LSD	4.44	1.26	0.02	0.02
N 0 kg ha^{-1}	119.83 a	10.89a	0.33	0.30
N 75 kg ha^{-1}	128.18 b	12.53 b	0.34	0.30
N 150 kg ha^{-1}	143.99 c	14.18c	0.33	0.29
LSD	5.44	1.54	ns	ns

There are no statistical differences among the treatments having the same letter at 0.05 level according to LSD test. ns = not significant

Enriched rice straw compost application improved soil physical and biological properties and consequently increased sweet corn yields and nutrient availability. These results might be due to the effective use of the applied ERSC soil amendment compared to EOPEFBC. In this experiment, the use of enrichment material i.e. chicken manure and dolomite in both compost enhanced soil-nutrient status and organic matter content (Ogboghodo et al., 2005).

Sweet corn yields from ERSC treatment were significantly increased by 49,74% over EOPEFBC treatment. Therefore, regular application of organic amendments,such as rice straw compost which is available abundantly in the small scale agriculture, can sustain soil fertility and increase sweet corn yields.

The yield and yield components (Table 3) and ear quality (Table 2) produced by sweet corn plants were significantly affected by the nitrogen treatments (Table 2 and 3). These yield attributes increased as the nitrogen fertilizer rates increased from 0 to 150 kg ha^{-1}. It might be due to improved nutrients availability and enhanced growth of plant. This is in line with research in corn by Walsh et al. (2012). Mullins et al. (1999) also reported that nitrogen fertilization slightly increased plant growth and ear size of sweet corn.

Application of 150 kg N ha^{-1} not only enhanced the sweet corn yield but also improved the quality of grain as shown in higher sucrose content (as indicated by Brix Table 2). Grain sucrose content, which is the primary sugar in developing sweet corn grain, is closely related to the sweetness in sweetcorn (Reyes et al., 1982; Wong et al., 1994).

The uptake of N, P, and K at maximum vegetative stage is presented in Table 4. There is no significant differences were observed in the nutrient uptake among the enriched compost. Table 4 showed that ERSC application showed higher nutrient uptake value than EOPEFBC application, except on K uptake. The effect of nitrogen fertilizer on plant N, P, K uptake was significant. At all applied N levels plant nutrient uptake was in the order of 150 kg > 75 kg > 0 kg N ha^{-1} (Table 4). This growth parameters advantage that was achieved through greater nutrient uptake by sweet corn plant resulting increased height (Table 1), chlorophyll content (Table 1), ear quality (Table 2) and dry weight matter (Table 3) which eventually increased yield of sweet corn. This is in agreement with results by Berradaa and Halvorson (2012).

Table 4. Effects of application of enriched compost and different nitrogen fertilizers rates on N, P, K leaf uptake

Treatment	N uptake (%)	P uptake (%)	K uptake (%)
Enriched ricestraw compost	2.27	0.31	4.53
Enriched empty fruit bunch compost	2.24	0.29	4.56
LSD	ns	ns	ns
N0 kg ha^{-1}	1.95 a	0.26 a	4.15 a
N75 kg ha^{-1}	2.17 b	0.30 b	4.39 a
N 150 kg ha^{-1}	2.64 c	0.33 c	5.09 b
LSD	0.22	0.02	0.54

There are no statistical differences among the treatments having the same letter at 0.05 level according to LSD test. ns = not significant

Composting and fertilizer Nitrogen does not provide significant interaction effect on all parameters. This is presumably because the time of application of compost and fertilizer nitrogen that is not the same.

CONCLUSION

The enriched paddy straw compost was better than enriched oil palm empty fruit bunch compost in improving the growth and yield of sweetcorn. The vegetative growth, yield and uptake of N, P, and K at recommended 150 kg Nitrogen ha^{-1} was improved over the control. Hence, we recommend the use integrated of enriched rice straw compost and inorganic fertilizers for improving sweet corn yield and soil fertility restoration.

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3b. Growth and yield of sweet corn as affected by paddy straw plant compost and potassium fertilizer

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Abstract

Information on the combined effect of enriched paddy straw compost and potassium fertilizer is needed for tropical regions. The objective of the research was to study the application of plant compost (paddy straw(Oryza sativa) compost and enriched paddy straw compost) and potassium fertilizers doses on the growth and yield of sweet corn. The experiment was conducted in Bandar Lampung, Indonesia from December 2014 until March 2015. The experimental design was factorial design 2 x 3 within completely randomized block design with 3 replications. The first factor wereplant compost and enriched paddy straw compost. Chicken manure and dolomite were added to enrich the quality of compost. Experiment showed that enriched paddy straw compost showed maintain better growth and higher yield of sweet corn than standard paddy straw compost. The application of potassium fertilizers combined with enriched paddy straw compost showed the better growth, a higher N, P and K uptake. In consequence, application of compost for sweet corn can be adapted with material in situ such as straw paddy rice.

Key words: rice straw compost,compost, Potassium, nutrient uptake

INTRODUCTION

Organic materials play an important role in improving the fertility of physical, chemical and biological soil. Compost as soil amendment improve the soil quality by enhancing mainly aggregrate stability and water status, which stimulates plant growth and yield Diacono and Montemurro, 2010) . Organic amendments can increase yield of crops. Eghball et al 2004 found that compost application increased corn crop production for one year and influenced soil properties for several years.

Efforts to increase sweet corn production can be done by utilizing the resources of surrounding the farmer land. The plant resources that are available in abundance in farmer land is paddy rice straw. Rice straw is a rich source of organic fertilizer nutrients, however processing and utilization of rice straw is still also very rare. For every ton of dry milled grain rice in Indonesia produced 1.5 tons of straw containing 9 kg N , 2 kg P and 25 kg K (Makarim *et al*. 2007). After the harvest is completed, the farmers are usually burning rice straw, which is not appropriate for sustaining agriculture production.

Compost is a poor source of nutrient including K. Mengel and Kirkby (1978) said that mineral K is available foruptake by plants and for exchange and fixation onthe secondary clay minerals, and leaching. Nowadays, sustainable agriculture production focusses in using organic sources for improving soil productivity inorder to reduce the use of inorganic fertilizers. The aim of the experiment is to investigate the effects of paddy straw compost and potassium fertilizer on the growth, yield and mineral nutrients uptake of sweet corn.

MATERIALS AND METHODS

This study was conducted at the farmer field, Kota Sepang, Bandar Lampung, Indonesia during rainy season. Soil and compost were analyzed at Soil and Plant Laboratory, Lampung University. The experimental design was factorial fitted to randomized complete block with three replication. The treatments were as follows (1) two type of compost i.e. standard paddy straw compost and enriched paddy straw compost and (2) three KCL fertlizer levels i.e.K0 = 0 kg KCl ha^{-1}; K1 = 100 kg KCl ha^{-1}; K2 = 200 kg KCl ha^{-1} (recommended dose).

Compost making procedure was conducted following procedure by Pangaribuan, et al. (2016). Enriched compost was prepared from paddy rice straw (60%), chicken manure (30%), dolomite (10%), rice bran, crushed paddy husk, and fermented EM solution (5 mL of EM + 10 ml molasse + 1985 mL of dechlorinated water and mixed solution was kept at room temperature to ferment for 3 days). Compost was mixed and sprayed with fermented EM solution until the moisture content of compost reach to 50%. After 14-21 days the fermented compost was ready to be used. The chemical characteristics of standard paddy straw compost were pH 8,01, C-Organic 11.58%, N-tot 1,22%, P-tot 0,50%, K-tot 1.17%. Whereas the chemical characteristics of enriched paddy straw compost were pH 7.51, C-Organic 16.66%, N-tot 1,87%, P-tot 0.47%, K-tot 1.62%.

Sweet corn hybrid Jambore was used in the present study and planted in 70 x 20 cm within 3 x 3 m^2 treatment site. It matures in 70 days. Thinning was done at 14 days after sowing (DAS) by leaving one healthy seedling per hill. . Fields were kept weed free by hand weeding at 20–25 d intervals.

A fertilizer dose of Urea, SP36 and KCL was uniformly applied to soll plots. Nitrogen fertilizer (Urea 300 $kgha^{-1}$) was given in three equal split, phosphorous (SP36 150 kg $kgha^{-1}$) was given entirely at planting time, and potassium (KCl as per treatment) was given in two equal split.

Soil samples were taken from 0 to 15 cm depth in treatment plots before planting for soil analyses. Plant samples were taken from the border rows of the treatment plots and analyzed for nutrient uptake. The parameters recorded were vegetative and generative growth and chlorophyll content (by Model SPAD 502, Minolta, Japan). The uptake of N,P and K by sweet corn crop was computed on the basis of dry matter accumulation. Sucrose content in sweet corn plant at harvest was estimated from reading Brix. The effects of compost and potassium fertilizers were analysed using ANOVA, with means seperated by the LSD test ($P \leq 0,05$)..

RESULTS AND DISCUSSION

The results of soil analyses site werepH (6,23), organic matter (1,45%), N total 0,15%, available P 5,31 ppm, available K 19,70 ppm.The soil is loamy soil in texture.Pre-treatment analyses showed the soil was low in fertility indicated by low C organic content and low Nutrient availability.

Vegetative and generative plant growth was significantly affected by organic compost and inorganic fertilizer treatments. There was an interaction effect of combined used of paddy straw compost and potassium fertilizers on the plant height and number of leaves (Table 1), the plant yield and N uptake (Table 2), and P uptake on the K uptake (Table 3).

Table 1. Interaction Effect of combined used of TKKS and Potassium fertilizers on the plant height and number of leaves

KCl Fertilizer	Plant height		Number of leaves	
	Standard paddy straw compost	Enriched paddy straw compost	Standard paddy straw compost	Enriched paddy straw compost
0 kg ha^{-1}	156.33 a A	199.13 b B	11.27 a A	13.13 b A
100 kg ha^{-1}	197.67 a B	208.27 a A	13.07 a B	13.20 a A
200 kg ha^{-1}	209.47 a B	221.53 a B	13.40 a B	13.80 a B
LSD	19.22		0.80	

There are no statistical differences among the treatments having the same small letter at the same row and the same big letter at the same column at 0.05 level according to LSD test.

Theaverage plant height and number of leaves increasedas the compost was enhanced and the levels of inorganic potassium fertilizersapplication increased. The best plant height andnumber of leaves were recorded under combinedtreatment with 200 kg.KCl ha^{-1} and enriched paddy straw compost (Table 1).

Table 2. Interaction Effect of combined used of TKKS and Potassium fertilizers on the PlantYield and Nitrogen uptake

KCl Fertilizer	Plant Yield		Nitrogen Uptake	
	Standard paddy straw compost	Enriched paddy straw compost	Standard paddy straw compost	Enriched paddy straw compost
0 kg ha^{-1}	14.11 a	13.53 a	0.54 a	0.77 b
	A	A	A	A
100 kg ha^{-1}	14.26 a	16.65 a	0.68 a	0.99 b
	A	B	B	A
200 kg ha^{-1}	15.80 a	17.53 a	0.78 a	0.71 a
	A	B	B	A
LSD	0.20		1.89	

There are no statistical differences among the treatments having the same small letter at the same row and the same big letter at the same column at 0.05 level according to LSD test.

Sweet corn yield of plot given high doses inorganic KCl fertilizer did not significantlly different with medium doses treatment at the same standard paddy straw compost (Table 2), this is confirmed by Rossen and Allan (2007) who stated that provided that nutrient supply is equal, yields with organic sources tend to be similarto those with inorganic sources.

Table 2 showed that theaverage plant yield and Nitrogen uptake increasedas the compost was enhanced and the levels of inorganic KCl fertilizersapplication increased. The best plant yieldwas noted under combinedtreatment with 200 kg KCl ha^{-1} and enriched paddy straw compost. The combined treatment of 100 kg KCl ha-1 and enriched paddy straw compost showed the highest Nitrogen uptake.

Table 3. Interaction Effect of combined used of TKKS and P uptake on the K uptake

KCl Fertilizer	P uptake		K uptake	
	Standard paddy straw compost	Enriched paddy straw compost	Standard paddy straw compost	Enriched paddy straw compost
0 kg ha^{-1}	0.08 a	0.08 a	1.18 a	1.57 b
	A	A	A	A
100 kg ha^{-1}	0.08 a	0.10 a	1.30 a	1.78 b
	A	B	A	A
200 kg ha^{-1}	0.09 a	0.10 b	1.66 a	1.44 a
	A	B	B	A
LSD	0.01		0.37	

There are no statistical differences among the treatments having the same small letter at the same row and the same big letter at the same column at 0.05 level according to LSD test.

Result of experiment showed that Theaverage P uptake and K uptake increasedas the compost was enhanced and the levels of inorganic potassium fertilizersapplication increased. The highest P uptake was found under combinedtreatment with 200 kg.KCl

ha^{-1} and enriched paddy straw compost, and the highest K uptake was noted under combined treatment with 100 kg.KCl ha^{-1} and enriched paddy straw compost (Table 3).

DISCUSSION

This experiment showed that enriched straw compost used promotes the vegetative and generative growth and nutrient uptake of sweet corn. This finding is similar to that of similar researcher who reported better growth and yield of sweet corn (Pangaribuan, 2016).

Barker and Bryson (2006)suggested, fertilization with composts might be more beneficial for increasing plant growth when the compost isenriched with nutrients. In this experiment, lime is added to composts for pathogen or acidity control (Barker 1997) thereby increasing the Ca content.The improvements in sweet corn growth and increasesin corn yields in organic enriched compost due partially to large increases in soil microbial biomass afterorganic fertilizer applications, leading to production of hormones or humates in the composts acting as plantgrowthregulators independent of the nutrient supply (Tu et al, 2006).

Potassium fertilization helps toimprove sweet corn yield. Inthe current studies it was observedthat increased K fertilization enhanced vegetative (plant height, number of leaves), yield and nutrient uptake significantly. Potassium is essential for plant growth and developmentPotassium (K+) hassignificant effect on protein synthesis,stomatal movement, enzymeactivation, water relation andphotosynthesis in plants (Marchner,1995). K must be supplied to ensure satisfactory crop performance, yield and quality of crops. Researcher (Hussain, 2015) found that potassium fertilization enhancednutrient uptake, growthparameters, physiological traits andnutrient uptake of corn plants significantly. Awad et al. (2014) stated that K is involved in controllingcell water content, photosynthetic activity and in the translocationof assimilates to fruit and other active sinks. Furthermore Zorb et al., (2014) said that Potassium plays a major role in sugar transport and starch accumulation in plants.

In general, there was an increase in N, P and K uptake in sweet corn plant as the K level was increased. Highest N, P and K nutrient uptake was found in the order of high doses (200 kg ha^{-1}), medium doses (100 kg ha^{-1}), and no fertilizers (0 kg ha^{-1}). Nitrogen, Phosphorous and Potassium uptake also depends on plant factors, including genetics and developmental stage i.e. vegetative versus reproductive stages (Rengel et al., 2008). Nitrogen, Phosphorous and Potassium play a vitalrole in many physiological processes such as photosynthesis, activation of plant enzym, flavour, carbohydrate transport, regulation of plant stomat, protein formation, and water use efficiency (Fageria, 2001;Fageria and Moreira, 2011; Wang et al 2009).

Interaction enrichedcompost with 100 kg / ha KCl was not significantly different from the enrichedd compost with 200 kg / ha KCl (Table 2), showed that enriched compost require less KCl fertilizer as much as 100 kg / ha, to produce sweet corn production. This is possibly because based on the analysis of nutrients, the content of K2O in encrihed compost was sufficient. Plant responses to K fertilizers wasinfluenced by the content of K in the soil and organic matter is the key to improving the productivity of soil and fertilizer efficiency. So in order to support the increased of sweet corn yield, requires a combination of fertilizer and organic matter. Ortiz-Escobar and Hue, (2011) said that . Amending the soil with good-quality composts (characterized by low C/N ratio and high N, P, K, and micronutrients) is essential to providing adequate nutrients in organic farming.Overall, it can be concluded that an appropriate nutrient supply, either organic ormineral, is crucial to reach high yields in sweet corn development

This experiment showed revealed that organic enriched paddy straw compost and potassium fertilizer applications are very essential for enhancingsoil nutrient uptake and increasing sweet corn yield. Futher research combining with other fertilizers such as Nitrogen and Phosphorous fertilizers may be undertaken to explore the most appropriate combined compost and fertilizer for sweet corn cultivation in the tropics.

CONCLUSION

Organic enriched paddy straw compost and potassium fertilizer applications are very essential for enhancingsoil nutrient uptake and increasing sweet corn yield. The vegetative growth, yield and uptake of N, P, and K at recommended 100 kg Potassium ha^{-1} was improved over the control. Therefore, we recommend the use of compost for sweet corn by utilizing material in situ such as straw paddy rice.

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***3c. Pengaruh Pemberian Ekstrak Daun Lamtoro Dan Pupuk Nitrogen Terhadap Pertumbuhan Dan Produksi Tanaman Jagung Manis (Zea Mays L. Saccharata* Sturt.)**

ABSTRAK

Upaya terus dilakukan untuk meningkatkan produksi jagung manis salah satunya dengan melakukan pemupukan.Sumber pupuk nabati sumber Nitrogen seperti ekstrak lamtoro belum banyak diteliti. Tujuan penelitian ini adalah untuk mengetahui pengaruh pemupukan ekstrak daun lamtoro terhadap pertumbuhan dan produksi jagung manis Penelitian ini menggunakan rancangan acak kelompok (RAK), dengan lima perlakuan yaitu tanpa pemberian pupuk, pemberian pupuk urea dosis 300 kg/ha, pemberian pupuk organik cair daun lamtoro dengan konsentrasi 500 cc/ l air (diaplikasikan ke daun satu kali seminggu mulai umur 2MST sampai 7MST), pemberian urea (pupuk dasar) dosis 150 kg/ha + pupuk organik cair daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 2MST sampai 7MST), pemberian urea dosis (pupuk dasar) 150 kg/ha + pupuk organik cair daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 5 MST sampai 7MST), dan setiap perlakuan terdiri dari 3 ulangan. Hasil penelitian ini menunjukan bahwa (1) Ekstrak lamtoro dapat dijadikan alternatif sumber pupuk nitrogen nabati, yang terbukti dari produksi jagung manis hasil aplikasi ekstrak lamtoro sama dengan produksi jagung manis dengan aplikasi pupuk rekomendasi nitrogen. (2) Pemberian pupuk urea (pupuk dasar) dosis 150 kg/ha dan pupuk organik cair daun lamtoro dengan konsentrasi 500 cc/l air memberikan hasil cenderung lebih TINGGI terhadap pertumbuhan dan produksi tanaman jagung manis.

Kata kunci: Tanaman jagung manis, ekstrak daun lamtoro, pupuk urea

PENDAHULUAN

Jagung manis(*Zea mays* L. *saccharata Sturt*.) merupakan salah satu tanaman pangan yang dikonsumsi dansangat disukai masyarakat di Indonoesia. Tanaman jagung manis memiliki rasa yang lebih manis dibandingkan dengan jagung biasa dan umur produksinya yang lebih singkat. Bagi para petani tanaman ini merupakan peluang usaha di pasar, karena nilai jualnya yang tinggi.

Saat ini permintaan terhadap jagung manis semakin meningkat, hal ini mendorong para petani untuk melakukan perbaikan terhadap sistem budidaya untuk meningkatkan produksi. Menurut Badan Pusat Statistik (2013), produksi jagung di Lampung tahun 2013 adalah sebesar 1.646.662 ton dengan luas lahan panen 322.137 ha.Produksi ini menurun dibandingkan pada tahun 2012 yang mencapai 1.719.386 ton dengan luas lahan panen 338.885 ha.Faktor penting dalam peningkatan produksi jagung manis adalah salah satunya dengan pemupukan. Pemupukan adalah usaha pemberian pupuk untuk menambah unsur hara yang diperlukan tanaman dalam rangka meningkatkan pertumbuhan, produksi dan kualitas hasil tanaman.Perlunya dilakukan pemupukan karena ketersediaan unsur hara di dalam tanah rendah, terjadi kehilangan unsur hara melalui pencucian dan pengangkutan pada waktu panen, dan adanya keinginan untuk memaksimalkan keuntungan.

Pupuk yang dapat digunakan bisa berupa pupuk organik ataupun pupuk anorganik.Pupuk organik adalah pupuk yang sebagian besar atau seluruhnya terdiri atas bahan organik yang berasal dari tanaman contohnya yaitu daun lamtoro.Ekstrak daun lamtoro memilikifungsi selain sebagi pupuk organik, jugasebagai pestisida nabati. Sebagai pupuk daun lamtoromengandung 3,84%N, 0,20% P, 2,06% K, 1,31% Ca, 0,33% Mg(Saerodjotanoso, 1983). Palimbungan (2006) menyatakan bahwa pemberian ekstrak daun lamtoro pada dosis 250cc/l air memberikan pengaruh paling baik terhadap pertumbuhan dan produksi tanaman sawi.Pupuk anorganik diberikan secara terpisah pada saat tanaman berumur tertentu agar serapan hara lebih efisien. Hal ini dilakukan karena proses pelepasan hara pupuk anorgaik lebih cepat daripada pupuk organik(Martajaya dkk, 2010).Salah satu jenis pupuk anorganik yang sering digunakan adalah pupuk urea.

Penelitian ini bertujuan untuk :

(1) Mengetahui pengaruh pemupukan ekstrak daun lamtoro terhadap pertumbuhan dan produksi jagung manis.

(2) Mengetahui pengaruh kombinasi pemupukan ekstrak daun lamtoro dan pupuk urea terhadap pertumbuhan dan produksi jagung manis.

BAHAN DAN METODE

Penelitian ini dilaksanakan pada kebun yang terletak di Kelurahan Kota Sepang Jaya Kecamatan Labuhan Ratu dan dimulai pada bulan April sampai dengan Juni 2015. Benih yang digunakan adalah benih jagung manis varietas Bonanza. Penelitian ini menggunakan rancangan acak kelompok (RAK) terdiri atas lima perlakuan dan setiap perlakuan terdiri dari tiga ulangan. Perlakuan yang diterapkan dalam penelitian ini adalah tanpa pemberian pupuk (L0), pemberian pupuk urea dosis 300 kg/ha (L1), pemberian pupuk organik cair daun lamtoro dengan konsentrasi 500 cc/ l air (diaplikasikan ke daun satu kali seminggu mulai umur 2MST sampai 7MST) (L2), pemberian urea (pupuk dasar) dosis 150 kg/ha + pupuk organik cair daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 2MST sampai 7MST) (L3), pemberian urea dosis (pupuk dasar) 150 kg/ha + pupuk organik cair daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 5 MST sampai 7MST) (L4). Uji homogenitas ragam menggunakan uji Bartlett, selanjutnya data dianalisis dengan sidik ragam.Perbedaan nilai tengah diuji dengan uji Beda Nyata Terkecil (BNT) pada taraf 5%.

HASIL DAN PEMBAHASAN

Hasil Penelitian

Hasil penelitian membuktikan bahwa dengan perlakuan pemberian pupuk organik cair (POC) daun lamtoro dan pupuk nitrogen berpengaruh nyata terhadap tinggi tanaman, jumlah daun,diameter batang, panjang tongkol, diameter tongkol, bobot tongkol tanpa kelobot, bobot berangkasan kering, indeks kemanisan jagung, dan produksi jagung manis (Tabel 1).

Tabel 1. Rekapitulasi hasil analisis ragam pengaruh pemberian ekstrak daun lamtoro dan pupuk nitrogen terhadap pertumbuhan dan produksi jagung manis.

Variabel Pengamatan	Signifikasi
Tinggi tanaman	*
Jumlah daun	*
Diameter batang	*
Panjang tongkol	*
Diameter tongkol	*
Bobot tongkol berkelobot	tn
Bobot tongkol tanpa kelobot	*
Bobot berangkasan kering	*
Indeks kemanisan jagung	*
Produksi jagung manis	*

Keterangan :
* = berbeda nyata pada $\alpha = 5$ %
tn = tidak berbeda nyata pada $\alpha = 5$ %

Tinggi Tanaman

Hasil analisis ragam menunjukkan bahwa pemberian pupuk organik cair (POC) daun lamtoro dan pupuk nitrogen berpengaruh nyata terhadap tinggi tanaman jagung manis. Tabel 2 menunjukkan bahwa pada umur 3 MST, tinggi tanaman pada kontrol nyata lebih rendah daripada yang diberi perlakuan pupuk, sedangkan tinggi tanaman antar L1, L2, L3 dan L4 tidak berbeda nyata. Pada umur 7 MST, tinggi tanaman pada kontrol nyata lebih rendah daripada yang diberi perlakuan pupuk, sedangkan tinggi tanaman antar L2, L3 dan L4 tidak berbeda nyata.

Tabel 2. Pengaruh perlakuan pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen pada rata-rata tinggi tanaman jagung manis umur 3 dan 7 minggu setelah tanam (MST)

	Tinggi Tanaman (cm)	
Perlakuan	3 MST	7 MST
L0	15,13 b	130,33 c
L1	24,33 a	164,33 b
L2	26,26 a	175,20 ab
L3	31,33 a	182,87 a
L4	26,13 a	166,93 ab
BNT 5%	7,52	18,42

Keterangan :
L0 : kontrol
L1 : pemberian pupuk urea dosis 300 kg/ha
L2 : pemberian pupuk organik cair daun lamtoro dengan konsentrasi 500 cc/l air (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST hingga 7 MST)
L3 : pemberian pupuk urea (pupuk dasar) dosis 150 kg/ha + pupuk organik cair daun lamtoro dengan konsentrasi 500 cc/l air (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST hingga 7 MST)
L4 : pemberian pupuk urea (pupuk dasar) dosis 150 kg/ha + pupuk organik cair daun lamtoro dengan konsentrasi 500 cc/l air (diaplikasikan ke daun satu kali seminggu mulai umur 5 MST hingga 7 MST)
Nilai tengah yang diikuti huruf yang sama tidak berbeda nyata menurut uji BNT pada $\alpha = 5$ %

Pertumbuhan tinggi tanaman pada perlakuan L3menunjukkan rata-rata tinggi tanaman yang paling tinggi daripada perlakuan lainnya pada tanaman jagung manis umur 3 minggu setelah tanam (MST) dan 7 minggu setelah tanam (MST) yaitu sebesar 31,33 cm dan 182,87 cm. Sedangkan pada umur tanaman yang sama (3 MST dan 7 MST), pada perlakuan L0 yaitu kontrol (tanpa perlakuan) menunjukkan rata-rata tinggi tanaman yang paling rendah dibandingkan perlakuan lainnya yaitu sebesar 15,13 cm dan 130,33 cm.

Jumlah Daun

Tabel 3. Pengaruh perlakuan pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen pada jumlah daun tanaman jagung manis umur 3 dan 7 minggu setelah tanam (MST)

Perlakuan	Jumlah Daun (helai)	
	3 MST	7 MST
L0	6,26 b	9,00 b
L1	7,60 a	11,26 a
L2	8,20 a	12,00 a
L3	7,93 a	12,26 a
L4	7,40 ab	11,20 a
BNT 5%	1,31	1,15

Pertumbuhan jumlah daun pada perlakuan L2menunjukkan jumlah daun tertinggi pada tanaman jagung manis umur 3 minggu setelah tanam (MST) yaitu sebesar 8,2 helai, sedangkan pertumbuhan jumlah daun terendah yaitu sebesar 6,26 helai ditunjukkan pada perlakuan L0, yaitu tanpa perlakuan (kontrol).

Pada umur 7 minggu setelah tanam (MST), pada perlakuan L3 menunjukkan jumlah daun paling banyak daripada perlakuan lainnya yaitu sebesar 12,26 helai. Sedangkan pertumbuhan pada perlakuan L0, yaitu tanpa perlakuan (kontrol) menunjukkan jumlah daun paling sedikit yaitu sebesar 9 helai dibandingkan perlakuan lainnya pada tanaman jagung manis.

Diameter Batang

Tabel 4. Pengaruh perlakuan pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen pada rata-rata diameter batang tanaman jagung manis.

Perlakuan	Diameter Batang (mm)
L0	14,12 c
L1	17,42 b
L2	18,72 ab
L3	20,13 a
L4	17,45 b
BNT 5%	2,11

Hasil penelitian pada perlakuan L3 menunjukkan rata-rata diameter batang tertinggi sebesar 20,14 mm, sedangkan rata-rata diameter batang terendah adalah sebesar 14,12 mm yang ditunjukkan pada perlakuan L0, yaitu tanpa perlakuan (kontrol).

Panjang Tongkol dan Diameter Tongkol

Tabel 5. Pengaruh perlakuan pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen pada rata-rata panjang tongkol dan diameter tongkol tanaman jagung manis.

Perlakuan	Panjang Tongkol (cm)	Diameter Tongkol (cm)
L0	18,93 c	5,47 c
L1	20,36 ab	6,19 b
L2	20,05 b	6,06 b
L3	21,04 a	6,84 a
L4	20,24 ab	6,35 b
BNT 5%	0,89	0,33

Hasil penelitian menunjukkan pada perlakuan L3menunjukkan panjang tongkol dan diameter tongkol tertinggi sebesar 21,04 cm dan 6,84 cm, sedangkan panjang tongkol dan diameter tongkol terendah yaitu sebesar 18,93 cm dan 5,48 cm yang ditunjukkan pada perlakuan L0, yaitu kontrol (tanpa perlakuan).

Bobot Tongkol Berkelobot, Bobot Tongkol Tanpa Kelobot dan Bobot Berangkasan Kering

Tabel 6. Pengaruh perlakuan pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen pada bobot tongkol berkelobot, bobot tongkol tanpa kelobot dan bobot berangkasan kering tanaman jagung manis.

Perlakuan	Bobot Tongkol Berkelobot (kg/tongkol)	Bobot Tongkol Tanpa Kelobot (kg/tongkol)	Bobot Berangkasan Kering (g)
L0	0,173 b	0,141 c	67,96 b
L1	0,213 ab	0,210 ab	107,92 a
L2	0.230 a	0,231 ab	108,21 a
L3	0,232 a	0,238 a	115,50 a
L4	0,216 ab	0,188 b	98,90 a
BNT 5%	0,04	0,04	23,37

Hasil penelitian menunjukkan pada perlakuan L3 menunjukkan bobot tongkol berkelobot, bobot tongkol tanpa kelobot dan bobot berangkasan keringtertinggi sebesar 0,232 kg,0,238 kg dan 115,5 g, sedangkan bobot tongkol berkelobot, bobot tongkol tanpa kelobot dan bobot berangkasan kering terendah yaitu sebesar 0,173 kg,0,141 kg dan 67,96 gyang ditunjukkan pada perlakuan L0, yaitu kontrol (tanpa perlakuan).

Indeks Kemanisan Jagung

Tabel 7. Pengaruh perlakuan pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen pada indeks kemanisan jagung manis.

Perlakuan	Indeks Kemanisan Jagung (^{o}Briks)
L0	14,89 d
L1	15,26 bc
L2	15,55 ab
L3	15,75 a
L4	15,24 c
BNT 5%	0,29

Hasil penelitian menunjukkan pada perlakuan L3menunjukkan indeks kemanisan tertinggi sebesar 15,76 ^{o}Briks, sedangkan indeks kemanisan terendah yaitu sebesar 14,89 ^{o}Briks yang ditunjukkan pada perlakuan L0, yaitu kontrol (tanpa perlakuan).

Produksi Jagung Manis

Tabel 8. Pengaruh perlakuan pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen pada produksi jagung manis.

Perlakuan	Produksi jagung manis (kg/petak)
L0	5,70 b
L1	7,95 ab
L2	8,85 a
L3	9,90 a
L4	7,98 ab
BNT 5%	2,41

Hasil penelitian pada perlakuan L0 menunjukkan produksi jagung manis terendah sebesar

5,7 kg, sedangkan pada perlakuan L3 menunjukkan produksi jagung manis tertinggi sebesar 9,9 kg.

Pembahasan

Hasil penelitian menunjukkan bahwa pertumbuhan tertinggi tanaman jagung manis umur 3 MST dan 7 MST terdapat pada perlakuan L3, yaitu pemberian urea (pupuk dasar) dosis 150 kg/ha + pupuk organik cair (POC) daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST hingga 7 MST) sebesar 31,33 cm dan 182, 87 cm. Peningkatan tinggi tanaman terjadi karena nitrogen memacu pertumbuhan meristem apikal sehingga tanaman bertambah panjang jika dibandingkan dengan tanaman tanpa pemberian nitrogen (Rahmah dkk, 2014).

Pemberian pupuk organik cair pada perlakuan L2 yaitu pemberian pupuk organik cair (POC) daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST hingga
7 MST) dan L3 yaitu pemberian urea (pupuk dasar) dosis 150 kg/ha + pupuk organik cair (POC) daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST hingga 7 MST) memiliki jumlah daun terbanyak. Menurut Trisnadewi dkk(2008), meningkatnya kadar nitrogen tanah akibat pemupukan, meningkatkan kadar nitrogen pada jaringan tanaman. Semakin tinggi kadar nitrogen mengakibatkan pertumbuhan tanaman semakin terpacu, sehingga tanaman menjadi lebih tinggi, diameter batang lebih lebar, jumlah daun lebih banyak, daun lebih luas dan akhirnya berat kering yang dihasilkan lebih tinggi.

Bobot berangkasan kering tanaman tertinggi dihasilkan pada perlakuan L3 yaitu pemberian urea (pupuk dasar) dosis 150 kg/ha + pupuk organik cair (POC) daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST hingga 7 MST). Adanya peningkatan bobot kering dikarenakan pada perlakuan L3, tanamanmenyerap air dan hara lebih banyak, unsur hara memacu perkembangan organ pada tanaman seperti akar, sehingga tanaman dapat menyerap hara dan air lebih banyak selanjutnya aktifitas fotosintesis akan meningkat dan mempengaruhi peningkatan bobot kering tanaman.

Pada perlakuan L3, yaitu pemberian urea (pupuk dasar) dosis 150 kg/ha + pupuk organik cair (POC) daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST hingga 7 MST) menunjukkan panjang tongkol tertinggi sebesar 21,04 cm. Hal ini disebabkan karena pada perlakuan ini mendapatkan unsur N yang cukup yang sangat berpengaruh dalam pembelahan sel dan bertambahnya ukuran tongkol.Menurut Puspadewi dkk (2014), pertambahan panjang tongkol jagung manis memungkinkan banyaknya biji yang akan terbentuk pada tongkol jagung manis, dalam hal ini kebutuhan energi untuk pembentukan biji jagung manis semakin meningkat. Unsur N sangat berpengaruh karena merupakan unsur penting bagi pembelahan sel yang akan menunjang pertumbuhan tanaman baik bertambahnya ukuran dan volume.

Pada perlakuan L3, yaitu pemberian urea(pupuk dasar) dosis 150kg/ha + pupuk organik cair (POC) daun lamtoro 500 cc/l (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST hingga 7 MST) menunjukkan diameter tongkol tertinggi sebesar 6,84 cm. Terpenuhinya kebutuhan akan unsur hara, cahaya dan air menjadikan hasil fotosintesis akan terbentuk dengan baik. Fotosintat yang dihasilkan akan ditransfer dan disimpan dalam biji pada saat pengisian biji. Hal ini disebabkan oleh unsur yang diserap oleh tanaman akan dipergunakan untuk pembentukan protein dan lemak yang nantinya akan disimpan dalam biji.

Unsur nitrogen (N) sangat bermanfaat bagi pembentukan klorofil yang sangat penting untuk proses fotosintesis sehingga dapat meningkatkan pertumbuhan tanaman. Jika proses fotosintesis dalam suatu tanaman berjalan baik maka pertumbuhan tanaman akan optimal dan menghasilkan hasil yang optimal pula. Luas daun pada tanaman akan mempengaruhi pembentukan fotosintat tanaman. Semakin tinggi atau luas daun tanaman, maka akan berbanding lurus dengan pembentukan fotosintat pada tanaman. Fotosintat pada fase vegetatif, selanjutnya akan didistribusikan ke bagian penting tanaman sebagai indikator pertumbuhan tanaman. Fotosintat pada fase generatif berperan penting dalam pembentukan organ reproduktif tanaman dan pembentukan tongkol dan biji yang akan menjadi acuan hasil panen jagung manis**.**

Fosfor sangat mempengaruhi pembentukan tongkol. Fosfor dapat memperbesar pembentukan buah, selain itu ketersediaan fosfor sebagai pembentuk ATP akan menjamin ketersediaan energi bagi pertumbuhan sehingga pembentukan asimilat dan pengangkutan ke tempat penyimpanan dapat berjalan dengan baik. Hal ini menyebabkan tongkol yang dihasilkan berdiameter besar (Ayunda, 2014).

Menurut Palungkun dan Budiarti (1995), unsur P dibutuhkan untuk pembentukan biji menjadi sempurna, apabila kekurangan P pembentukan biji dalam barisan tidak sempurna serta ukuran biji kecil.Selain itu, kekurangan unsur K dapat menyebabkan pertumbuhan tongkol dan pertumbuhan biji menjadi tidak sempurna, serta ujung tongkol bagian atas tidak berisi.

Pada perlakuan kontrol (seluruh tanaman disiram air) menunjukkan pertumbuhan tanaman jagung manis yang lebih lambat dan hasil produksi yang lebih rendah dibandingkan dengan perlakuan lainnya yang diberikan pupuk. Hal ini disebabkan karena pada perlakuan kontrol mendapatkan pasokan unsur nitrogen yang sangat rendah.Kekurangan nitrogen dapat menurunkan jumlah klorofil suatu tanaman, sehingga laju fotosintesis yang terjadi berkurang dan hasil fotosintatnya juga berkurang yang pada akhirnya nanti hasil tanaman juga menjadi berkurang.

Pada perlakuan tanaman yang diberikan pupuk N dan pupuk organik cair daun lamtoro menghasilkan perkembangan tanaman jagung manis yang lebih baik diduga karena pemberian unsur hara sudah tersedia dalam jumlah yang optimal dan seimbang sehingga pemberian pupuk N dan pupuk organik cair daun lamtoro telah mampu memberikan keseimbangan anatara unsur hara makro dan mikro pada tanaman jagung manis.

Pemberian pupuk organik ditambah dengan pupuk anorganik dapat menghasilkan pertumbuhan, perkembangan dan hasil jagung manis yang lebih baik, karena pupuk organik dapat memperbaiki sifat-sifat fisika tanah terutama tekstur tanah, daya mengikat air, akan tetapi tidak dapat memberikan unsur hara yang cukup terhadap jagung manis. Sebaliknya, pada pupuk organik dapat memenuhi unsur hara yang dibutuhkan oleh tanaman jagung manis tetapi tidak dapat memperbaiki sifat fisik tanah.

Kombinasi pemberian pupuk organik yang dipadukan dengan pupuk anorganik dapat menciptakan kondisi tanah yang terpelihara dengan baik sehingga akan meningkatkan produktivitas tanaman, efisien dalam penggunaan pupuk dan dapat mengurangi biaya penggunaan pupuk anorganik yang berlebihan dengan diganti menggunakan pupuk organik yang lebih mudah didapatkan dan lebih baik dalam penggunaannya dalam jangka waktu yang lebih lama.

KESIMPULAN

Berdasarkan dari hasil penelitian yang dilakukan dan pembahasan diperoleh kesimpulan yaitu

(1) Pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen pada tanaman jagung manis berpengaruh nyata terhadap tinggi tanaman, jumlah daun, diameter batang, panjang tongkolm diameter tongkol, bobot tongkol tanpa kelobot, bobot berangkasan kering, indeks kemanisan jagung dan produksi jagung manis.

(2) Pemberian pupuk urea (pupuk dasar) dosis 150 kg/ha dan pupuk organik cair daun lamtoro dengan konsentrasi 500cc/l air (diaplikasikan ke daun satu kali seminggu mulai umur 2 MST sampai 7 MST) memberikan hasil cenderung lebih baik terhadap pertumbuhan dan produksi tanaman jagung manis.

SARAN

Berdasarkan penelitian yang telah dilakukan dalam pemberian pupuk organik cair daun lamtoro dan pupuk nitrogen disarankan perlu dilakukan penelitian lainnya dengan penggunaan pupuk organik cair lainnya dari bahan organik selain dari daun tanaman dan penggunaan dosis yang lebih rendah.

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LAMPIRAN

1. ***Accepetance letter for journal Acta Horticulturae for 2017***

2. ***Acceptance letter for publication in proceeding international 2017***

3. ***Acceptance letter for International Seminar in Jogjakarta, Indonesia, Januari 2017***

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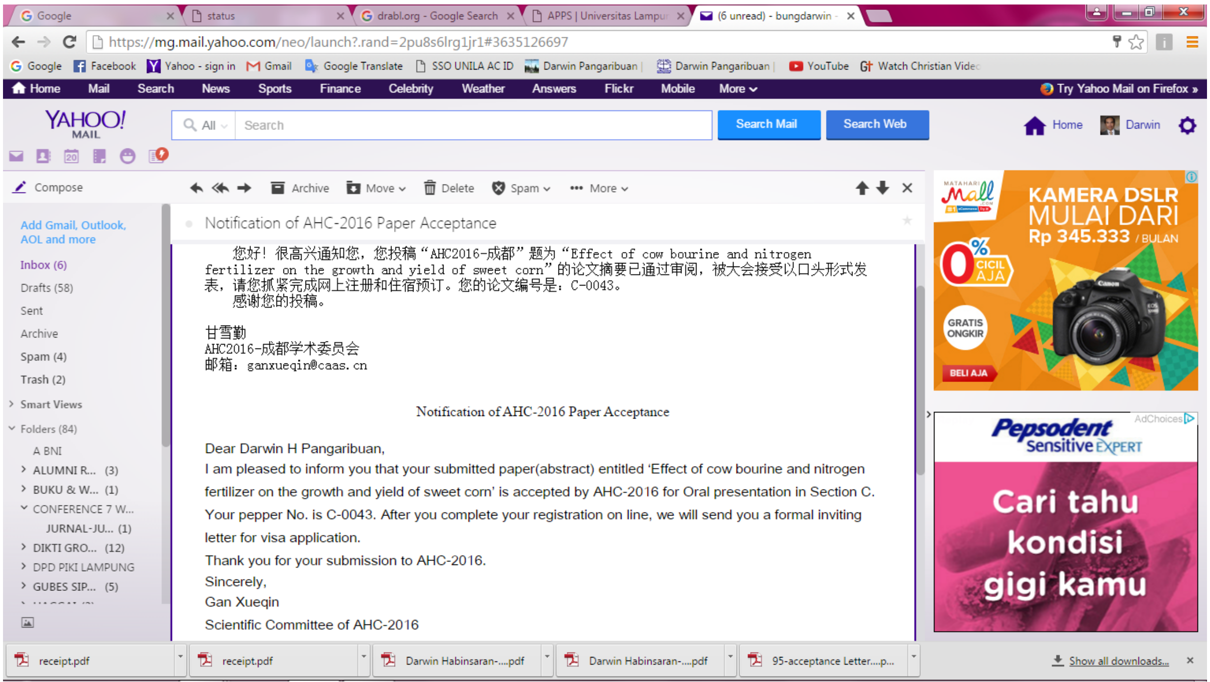
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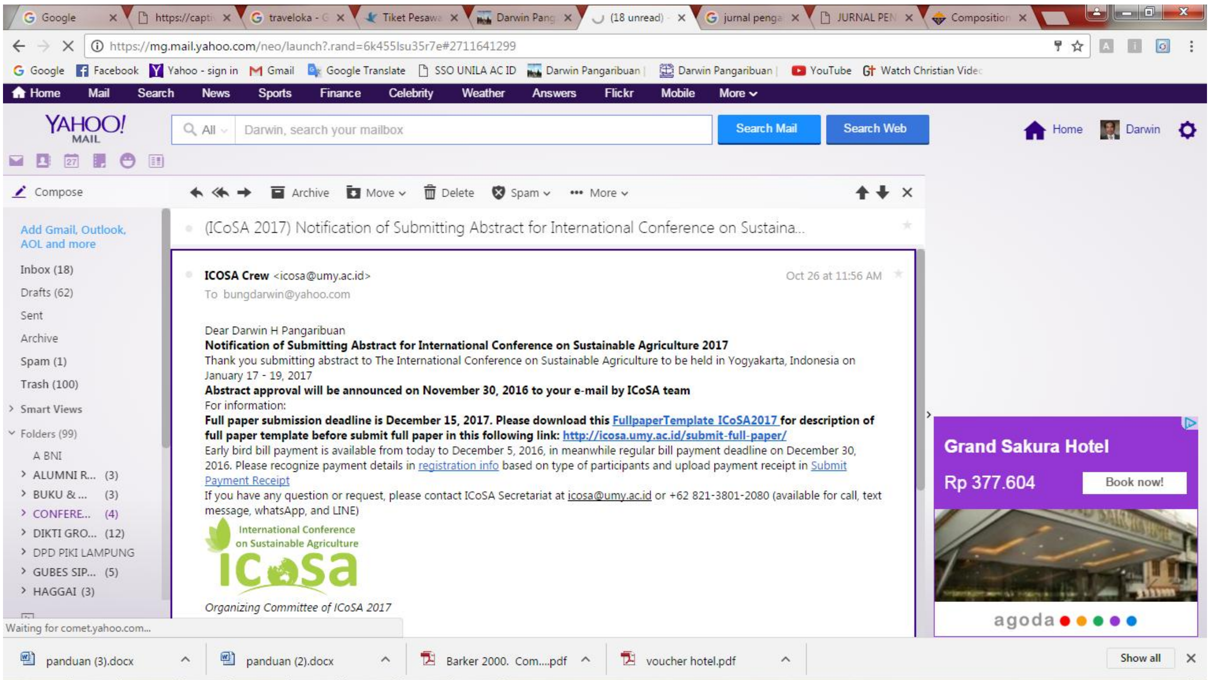

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The effect of enriched compost and nitrogen fertilizer on the growth and yield of sweet corn (*Zea mays* L.)

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Abstract

The integrated use of enriched plant compost and nitrogen fertilizers are one of the main considerations in improving sweet corn productivity in the tropics. An experiment was conducted to determine the effects of enriched compost and nitrogen fertilizer on the growth, yield and mineral nutrients uptake of sweet corn. The treatments involved two enriched compost (rice straw and empty fruit bunches of oil palm) subjected to three levels of nitrogen fertilizer (0, 75, 150 kg N ha^{-1}). The 6 treatment combinations were laid out in a factorial experiment and fitted into a complete randomized block design with three replications. Compost was enriched by adding chicken manure and dolomite. Growth parameters, nutrient uptake and yield attributes were assessed. Result of the experiment showed that enriched rice straw compost showed better vegetative and yield than enriched oil palm empty fruit bunch compost. The application of full recommended nitrogen fertilizers had the higher yield as compared with other treatments. This implied that the use of enriched rice straw compost and recommended nitrogen fertilizers could be advisable to be applied for the small scale agriculture cultivation in the red acid Ultisol soil.

Keywords: rice straw compost, oil palm empty fruit bunch compost, urea, ear quality, nutrient uptake

INTRODUCTION

To maintain soil fertility, agricultural waste must be returned to the soil in the form of compost. The use of compost as a natural fertilizer has increased lately, especially with the development of organic agriculture and the increasing demand for organic food. Types of basic materials for compost abundant around the agricultural community in tropical regions are rice straw and oil palm empty fruit bunch.

The palm oil industry generates an abundance of oil palm biomass such as empty fruit bunches. Processing and utilization empty fruit bunches by palm oil mill is still very limited. In addition to that, processing and utilization of rice straw is still also very rare. After the harvest is completed, the farmers are burning rice straw.

Oil palm empty fruit bunches contains various macro and micro nutrients essential for plant growth, among others: 42.8% C; 2.9% K_2O; 0.8% N; 0.22% P_2O_5; 0.30% MgO, 23 ppm Cu and 51 ppm Zn (Singh et al., 1989). Rice straw is a rich source of organic fertilizer nutrients. Rice straw consists of Si (4-7%), K (1.2-1.7%), N (0.5-0.8%) and P (0.07-0.12) (Dobermann and Fairhurst, 2000).

According to Palm et al. (2001) application of organic matter plays a critical role in both of short-term nutrient availability and longterm maintenance of soil organic matter in farming systems in tropical agro ecosystems. This experiment used the basic ingredients of empty fruit bunches of oil palm and rice straw which have been enriched with chicken manure and dolomite, so that each becomes the enriched oil palm empty fruit bunches compost (EOPEFBC) and enriched rice straw compost (ERSC). Composted organic material from plants will more quickly decompose when coupled with enrichment materials. Enriched compost will increase soil fertility and improve the productivity of sweet corn.

The nutrients nitrogen, phosphorus and potassium are a major limiting factor in the

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productivity of sweet corn. Sweet corn response to nitrogen is influenced by several factors such as the use of organic materials. Organic material is the key to improving the productivity of soil and fertilizer efficiency (Barker, 2010). The objective of the experiment is to study the effects of enriched compost and nitrogen fertilizer on the growth, yield and mineral nutrients uptake of sweet corn.

MATERIALS AND METHODS

A field study was conducted at the farmer field, Kota Sepang, Bandar Lampung, Indonesia. The experiment was factorial design within randomized complete block design (RCBD) with three replications. The treatments consisted of two types of enriched compost i.e., enriched rice straw compost and enriched oil palm empty fruit bunches compost combined with three nitrogen levels i.e., N0=0 kg N ha^{-1}; N1=75 kg N ha^{-1}; N2=150 kg N ha^{-1} (recommended dose).

Enriched compost was prepared from oil palm empty fruit bunch (60%) or rice straw (60%), chicken manure (30%), dolomite (10%), rice bran, crushed paddy husk, and fermented EM solution (5 mL of EM + 10 mL molasse + 1985 mL of dechlorinated water and mixed solution was kept at room temperature to ferment for 3 days). Compost was mixed and sprayed with fermented EM solution until the moisture content of compost reach to 50%. After 14-21 days the fermented compost was ready to be used.

Sweet corn hybrid ('Jambore') was used in this study. The plant distance was 70×20 cm, and block treatment was 3×3 m. N, P and K were applied in the form of Urea, SP36 and KCL, respectively. The entire quantity of P_2O_5 (75 kg ha^{-1}) and K_2O (50 kg ha^{-1}) was applied as basal at the time of sowing and N was applied in three splits, as basal, at knee-high and tasseling stages.

The study was conducted on Ultisols. Soil and compost were analyzed at Soil and Plant Laboratory, Lampung University. The soil characteristics of the experimental site were pH (6.23), organic matter (1.45%), N total 0.15%, available P 5.31 ppm, available K 19.70 ppm. The soil is loamy soil in texture. The chemical characteristics of ERSC were pH 8,18, C-Organic 25.33%, N-tot 1.69%, P-tot 0.08%, K-tot 0.88%, Ca: 2.15%, and Mg 0.40%; whereas the chemical characteristics of EOPEFBC were pH 7.51, C-Organic 16.66%, N-tot 1.87%, P-tot 0.47%, K-tot 1.62%, Ca 1.95%, and Mg 0.30%.

All the recommended cultural practices were used for the management of the experiment. There was no serious incidence of pests and diseases or nutrient deficiencies. Fields were kept weed free by hand weeding at 20-25 day intervals. The observations plant height, number of leaves, brix, length of ear, diameter of ear, ear weight with and without husk, production, chlorophyll content (by Model SPAD 502, Minolta, Japan), the uptake of N, P, K were recorded. The collected data were analyzed statistically by using Fisher's analysis of variance technique and individual treatment means were separated by using least significant difference (LSD) test at 5% probability level.

RESULTS AND DISCUSSION

The interaction effect between types of enriched compost and levels of nitrogen was found non-significant on all parameters observed. Data presented on the main effect of each factor.

The application of enriched compost and nitrogen fertilizers had significant effect on the mean plant height and chlorophyll content (Table 1). However, there was no significant differences on the number of leaves. Enriched rice straw compost (ERSC) showed higher significantly differences over enriched oil palm empty fruit bunch compost (EOPEFBC). This showed that enriched straw compost used promotes the vegetative growth of sweet corn. This finding is similar to that of other researcher who reported better vegetative growth of paddy rice (Barus, 2012) with rice straw compost addition. This confirmed the role of ERSC in promoting vigorous vegetative growth in sweet corn.

The chlorophyll content is an estimate of the N status. The significantly higher chlorophyll content of ERSC treatment than EOPEFBC could be due to differences in nitrogen uptake (Table 2). The greater chlorophyll values in sweet corn leaves is of importance because photosynthetic activity and crop yield may increase with increased chlorophyll content of leaves (Ofosu-Anim and Leitch, 2009).

Table 1. Effects of application of enriched compost and different nitrogen fertilizers rates on vegetative growth of sweet corn.

Treatment	Height (cm)	Number of leaves	Chlorophyll content (SPAD)
Enriched rice straw compost	234.91 a	12.87	53.39 a
Empty fruit bunch compost	219.98 b	12.51	49.38 b
LSD	8.74	ns	2.16
N 0 kg ha^{-1}	214.00 a	12.53	48.56 a
N 75 kg ha^{-1}	231.07 b	13.05	51.84 b
N 150 kg ha^{-1}	237.27 b	12.50	53.76 b
LSD	10.70	ns[1]	2.65

[1]ns: not significant.
There are no statistical differences among the treatments having the same letter at 0.05 level according to LSD test.

Table 2. Effects of application of enriched compost and different nitrogen fertilizers rates on N, P, K uptake.

Treatment	N uptake (%)	P uptake (%)	K uptake (%)
Enriched rice straw compost	2.27	0.31	4.53
Enriched empty fruit bunch compost	2.24	0.29	4.56
LSD	ns[1]	ns[1]	ns[1]
N 0 kg ha^{-1}	1.95 a	0.26 a	4.15 a
N 75 kg ha^{-1}	2.17 b	0.30 b	4.39 a
N 150 kg ha^{-1}	2.64 c	0.33 c	5.09 b
LSD	0.22	0.02	0.54

[1]ns: not significant.
There are no statistical differences among the treatments having the same letter at 0.05 level according to LSD test.

The growth vegetative parameters (height and chlorophyll content) increased significantly as the nitrogen rate increased from 0 to 150 kg ha^{-1}. This is due to enhanced availability of nitrogen in the soil which increased leaf area, and consequently resulting in higher photo assimilates and in more dry matter accumulation. These results are supported by the findings of Mullins et al. (1999).

There were significant effects of different enriched compost treatments on ear quality (Table 3) yield and yield attributes (Table 4) of sweet corn. With exception for ear length, application of ERSC significantly improved ear diameter, ear weight with husk, ear weight without husk, soluble solid (Table 3), dry weight matter, yield, harvest index with and without husk of sweet corn (Table 4).

The higher dry weight of nitrogen treated plants (Table 4) could be connected with the positive effect of nitrogen in some important physiological processes such as promoting shoot growth and protein synthesis (Barker, 2010). On the other hand Squire (1990) established that the main effect of N fertilizer is to increase the rate of leaf expansion, leading to increased interception of daily solar radiation by canopy. Better crop growth and development observed under N recommended dose (150 kg ha^{-1}) suggest that increasing crop fertilization to an optimum rate enables the plants to produce their potential vegetative and generative growth, and consequently enhance plant photosynthetic activities and hence more dry matter is produced (Akanbi and Togun, 2002).

Table 3. Effects of application of enriched compost and different nitrogen fertilizers rates on ear components of sweet corn.

Treatment	Ear diameter (cm)	Ear length (cm)	Ear weight with husk (kg)	Ear weight without husk (kg)	Soluble solid (°Brix)
Enriched rice straw compost	4.80 a	17.88	0.38 a	0.30 a	14.30 a
Enriched empty fruit bunch compost	4.46 b	16.82	0.32 b	0.26 b	13.21 b
LSD	0.07	ns	0.04	0.02	0.27
N 0 kg ha^{-1}	4.52 a	16.90	0.32	0.26 a	12.63 a
N 75 kg ha^{-1}	4.61 b	17.19	0.36	0.29 ab	13.70 b
N 150 kg ha^{-1}	4.76 c	17.79	0.38	0.30 b	14.93 c
LSD	0.09	ns[1]	ns[1]	0.03	0.33

[1]ns: not significant.

There are no statistical differences among the treatments having the same letters at 0.05 level according to LSD test.

Table 4. Effects of application of enriched compost and different nitrogen fertilizers rates on yield and harvest index of sweet corn.

Treatment	Dry weight matter (g)	Production (t ha^{-1})	Harvest index with husk	Harvest index without husk
Enriched rice straw compost	135.00 a	15.03 a	0.35 a	0.30 a
Empty fruit bunch compost	126.33 b	10.04 b	0.32 b	0.28 b
LSD	4.44	1.26	0.02	0.02
N 0 kg ha^{-1}	119.83 a	10.89 a	0.33	0.30
N 75 kg ha^{-1}	128.18 b	12.53 b	0.34	0.30
N 150 kg ha^{-1}	143.99 c	14.18 c	0.33	0.29
LSD	5.44	1.54	ns[1]	ns[1]

[1]ns: not significant.

There are no statistical differences among the treatments having the same letter at 0.05 level according to LSD test.

Enriched rice straw compost application improved soil physical and biological properties and consequently increased sweet corn yields and nutrient availability. These results might be due to the effective use of the applied ERSC soil amendment compared to EOPEFBC. In this experiment, the use of enrichment material i.e., chicken manure and dolomite in both compost enhanced soil-nutrient status and organic matter content (Ogboghodo et al., 2005).

Sweet corn yields from ERSC treatment were significantly increased by 49.74% over EOPEFBC treatment. Therefore, regular application of organic amendments, such as rice straw compost which is available abundantly in the small scale agriculture, can sustain soil fertility and increase sweet corn yields.

The yield and yield components (Table 4) and ear quality (Table 3) produced by sweet corn plants were significantly affected by the nitrogen treatments (Tables 3 and 4). These yield attributes increased as the nitrogen fertilizer rates increased from 0 to 150 kg ha^{-1}. It might be due to improved nutrients availability and enhanced growth of plant. This is in line with research in corn by Walsh et al. (2012). Mullins et al. (1999) also reported that nitrogen fertilization slightly increased plant growth and ear size of sweet corn.

Application of 150 kg N ha^{-1} not only enhanced the sweet corn yield but also improved the quality of grain as shown in higher sucrose content (as indicated by Brix; Table 3). Grain sucrose content, which is the primary sugar in developing sweet corn grain, is closely related to the sweetness in sweetcorn (Reyes et al., 1982; Wong et al., 1994).

The uptake of N, P, and K at maximum vegetative stage is presented in Table 2. Significant differences were observed in the nutrient uptake among the enriched compost. Table 2 shows that ERSC application showed significantly higher nutrient uptake value than EOPEFBC application. The effect of nitrogen fertilizer on plant N, P, K uptake was significant. At all applied N levels plant nutrient uptake was in the order of 150 kg > 75 kg > 0 kg N ha^{-1} (Table 4). This growth parameters advantage that was achieved through greater nutrient uptake by sweet corn plant resulting increased height (Table 1), chlorophyll content (Table 1), ear quality (Table 3) and dry weight matter (Table 4) which eventually increased yield of sweet corn. This is in agreement with results by Berrada and Halvorson (2012).

Composting and fertilizer Nitrogen does not provide significant interaction effect on all parameters. This is presumably because the time of application of compost and fertilizer nitrogen that is not the same.

CONCLUSIONS

The following conclusions can be drawn from the study:

- The enriched paddy straw compost was better than enriched oil palm empty fruit bunch compost in improving the growth and yield of sweetcorn.
- The vegetative growth, yield and uptake of N, P, and K at recommended 150 kg nitrogen ha^{-1} was improved over the control.
- Hence, we recommend the use integrated of enriched rice straw compost and inorganic fertilizers for improving sweet corn yield and soil fertility restoration.

ACKNOWLEDGEMENTS

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Growth and yield of sweet corn as affected by paddy straw plant compost and potassium fertilizer

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Abstract

Information on the combined effect of enriched paddy straw compost and potassium fertilizer is required for tropical regions. The objective of this research was to study the application of plant compost (paddy straw (*Oryza sativa*) compost and enriched paddy straw compost) and potassium fertilizers doses on the growth and yield of sweet corn. The experiment was conducted in Bandar Lampung, Indonesia from December 2014 until March 2015. The experimental design was a factorial design 2×3 within a completely randomized block design with 3 replications. The first factor was the type of plant compost and the second factor was the potassium fertilizers doses. Chicken manure and dolomite were added to enrich the quality of the compost. The experiment showed that enriched paddy straw compost promoted a steady better growth and higher yield of sweet corn than standard paddy straw compost. The application of potassium fertilizers combined with enriched paddy straw compost showed the best growth and N, P, K uptake. In consequence, application of compost for sweet corn can be adapted with material in situ such as straw paddy rice.

Keywords: enriched compost, plant compost, nutrient uptake, KCl

INTRODUCTION

Organic materials play an important role in improving the fertility of physical, chemical and biological soil. Compost, as the soil amendment, improves the soil quality by enhancing mainly the aggregrate stability and water status, which stimulates plant growth and yield (Diacono and Montemurro, 2010). Organic amendments can increase the yield of crops. Eghball et al. (2004) found that compost application increased the corn crop production for one year and influenced the soil properties for several years.

Efforts to increase the sweet corn production can be done by utilizing the resources from the surrounding farmland. The plant resource that are available and abundant in the farmland are paddy rice straw. Rice straw is a rich source of organic fertilizer nutrients, however, the utilization of rice straw is still very rare. In Indonesia, per t of dry milled grain rice produced 1.5 t of straw, containing 9 kg N, 2 kg P and 25 kg K (Makarim, 2007). After the harvest is completed, the farmers are usually burning rice straw, which is not appropriate for sustaining agriculture production.

Compost is a poor source of nutrients including K. Mengel and Kirkby (1978) said that mineral K was available for uptake by plants and for exchange and fixation on the secondary clay minerals and leaching. Nowadays, sustainable agriculture production focusses on using organic sources for improving soil productivity in order to reduce the use of inorganic fertilizers. The aim of the experiment is to investigate the effects of paddy straw compost and potassium fertilizer on the growth, yield and mineral nutrients uptake of sweet corn.

MATERIALS AND METHODS

This study was conducted at the farmer field in Kota Sepang, Bandar Lampung, Indonesia during the rainy season. The soil and compost were analyzed in the Soil and Plant

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Laboratory at the Lampung University. The experimental design was factorial fitted to randomized a complete block with three replications. The treatments were as follows: two types of compost, standard paddy straw compost and enriched paddy straw compost ; three KCl fertlizer levels, 0 kg KCl ha^{-1} (K0), 100 kg KCl ha^{-1} (K1), and 200 kg KCl ha^{-1} (K2, recommended dose).

The compost making procedure was conducted following the procedure by Pangaribuan et al. (2017). The enriched compost was prepared from paddy rice straw (60%), chicken manure (30%), dolomite (10%), rice bran, crushed paddy husk, and fermented EM (Effective Microorganism) solution (including 5 mL of EM, 10 mL molasse and 1985 mL of dechlorinated water, which was kept at room temperature to ferment for 3 days). The compost was mixed and sprayed with fermented EM solution until the moisture content of compost reach to 50%. After 14-21 days the fermented compost was ready to be used. The chemical characteristics of standard paddy straw compost were pH 8.01, C-Organic 11.58%, N-tot 1.22%, P-tot 0.50%, K-tot 1.17%. Whereas the chemical characteristics of enriched paddy straw compost were pH 7.51, C-Organic 16.66%, N-tot 1.87%, P-tot 0.47%, K-tot 1.62%.

The sweet corn hybrid 'Jambore' was used in the present study and planted in 70×20 cm within 3×3 m^2 treatment site. It matured in 70 days. Thinning was done 14 d after sowing (DAS) by leaving one healthy seedling per hill. Fields were kept weed free by hand weeding at 20-25 DAS intervals.

A fertilizer dose of Urea, SP36 and KCl was uniformly applied to soil plots. Nitrogen fertilizer (urea 300 kg ha^{-1}) was given in three equal split, phosphorous (SP36 150 kg ha^{-1}) was given entirely at planting time, and potassium (KCl as per treatment) was given in two equal split.

Soil samples were taken from 0 to 15 cm depth in treatment plots before planting for soil analyses. Plant samples were taken from the border rows of the treatment plots and analyzed for nutrient uptake. The parameters recorded were vegetative and generative growth and chlorophyll content (by Model SPAD 502, Minolta, Japan). The uptake of N, P and K by sweet corn crop was computed on the basis of dry matter accumulation. Sucrose content in sweet corn plant at harvest was estimated from reading Brix. The effects of compost and potassium fertilizers were analysed using ANOVA, with means seperated by the LSD test ($P \leq 0.05$).

RESULTS

The results of the soil analyses site were pH 6.23, organic matter 1.45%, N total 0.15%, available P 5.31 ppm, and available K 19.70 ppm. The soil texture was clay loam. Pre-treatment analyses showed that the soil had low C organic content and nutrient availability, indicating that there was an opportunity to improve soil fertility through compost application.

Vegetative and generative plant growth were significantly different between organic compost and inorganic fertilizer treatments. There was an interaction effect of combined used of paddy straw compost and potassium fertilizers on the plant height and number of leaves (Table 1), the plant yield and N uptake (Table 2), P uptake and K uptake (Table 3).

The average plant height and number of leaves increased as the compost was enhanced and the levels of inorganic potassium fertilizers application increased. The best plant height and number of leaves were recorded under combined treatment with 200 kg KCl ha^{-1} and enriched paddy straw compost (Table 1).

Table 2 showed that the average plant yield and nitrogen uptake increased as the compost was enhanced and the levels of inorganic KCl fertilizers application increased. The best plant yield was noted under combined treatment with 200 kg KCl ha^{-1} and enriched paddy straw compost. The combined treatment of 100 kg KCl ha^{-1} and enriched paddy straw compost showed the highest nitrogen uptake.

Results of the experiment showed that the average P uptake and K uptake increased as the compost was enriched and the levels of inorganic potassium fertilizers application increased. The highest P uptake was found under the combined treatment with 200 kg KCl ha-1 and enriched paddy straw compost, and the highest K uptake was noted under the combined treatment with 100 kg KCl ha-1 and enriched paddy straw compost (Table 3).

Table 1. Interaction effect of combined used of compost and potassium fertilizers on the plant height and number of leaves.

KCl fertilizer (kg ha-1)	Plant height (cm)		Number of leaves	
	Standard paddy straw compost	Enriched paddy straw compost	Standard paddy straw compost	Enriched paddy straw compost
0	156.33 a A	199.13 b A	11.27 a A	13.13 b A
100	197.67 a B	208.27 a A	13.07 a B	13.20 a A
200	209.47 a B	221.53 a B	13.40 a B	13.80 a A
LSD	19.22		0.80	

Different capital letters within the same column show significant differences between fertlizers doses by LSD test ($p \leq 0.05$). Different small letters within the same row show significant difference between compost type by LSD test ($p \leq 0.05$).

Table 2. Interaction effect of combined used of compost and potassium fertilizers on the plant yield and nitrogen uptake.

KCl fertilizer (kg ha-1)	Plant yield (t ha-1)		Nitrogen uptake (g plant-1)	
	Standard paddy straw compost	Enriched paddy straw compost	Standard paddy straw compost	Enriched paddy straw compost
0	14.11 a A	13.53 a A	0.54 a A	0.77 b A
100	14.26 a A	16.65 b B	0.68 a B	0.99 b A
200	15.80 a A	17.53 a B	0.78 a B	0.71 a A
LSD	1.89		0.20	

Different capital letters within the same column show significant differences between fertlizers doses by LSD test ($p \leq 0.05$). Different small letters within the same row show significant difference between compost type by LSD test ($p \leq 0.05$).

Table 3. Interaction effect of combined used of compost and P uptake on the K uptake.

KCl fertilizer (kg ha-1)	P uptake (g plant-1)		K uptake (g plant-1)	
	Standard paddy straw compost	Enriched paddy straw compost	Standard paddy straw compost	Enriched paddy straw compost
0	0.08 a A	0.08 a A	1.18 a A	1.57 b A
100	0.08 a A	0.10 b B	1.30 a A	1.78 b A
200	0.09 a A	0.10 b B	1.66 a B	1.44 a A
LSD	0.01		0.37	

Different capital letters within the same column show significant differences between fertlizers doses by LSD test ($p \leq 0.05$). Different small letters within the same row show significant difference between compost type by LSD test ($p \leq 0.05$).

DISCUSSION

This experiment showed that enriched paddy straw compost promoted the vegetative and generative growth and nutrient uptake of sweet corn. This finding was consistent with Pangaribuan et al. (2017).

In this experiment, lime (20%) was added to composts for pathogen or acidity control (Barker, 1997), thereby increasing the Ca content. In addition, chicken manure (20%) was also added to enrich the organic compost. The additional fertilizer aided the mineralization of nutrients. Lime and chicken manure improved the growth and yield of sweet corn because they enhanced nutrient supplies. Barker and Bryson (2006) suggested, fertilization with composts might be more beneficial for increasing plant growth when the compost is enriched with nutrients. The improvements in sweet corn growth and increases in sweet corn yields in organic enriched compost, were partially due to the large increases in soil microbial biomass after organic fertilizer applications. The soil microbial activity is leading to production of hormones or humates in the composts acting as plantgrowth regulators independent of the nutrient supply (Tu et al., 2006).

The sweet corn yield of the plot that was given high doses of inorganic KCl fertilizer, was not significantlly different from the medium doses treatment at the same standard paddy straw compost (Table 2). This result was consistent with Rosen and Allan (2007), who stated that yields of plants with organic sources tended to be similar to those with inorganic sources.

Potassium fertilization helps to improve sweet corn yield. In the current studies, increased K fertilization enhanced vegetative (plant height, number of leaves) growth, yield and nutrient uptake significantly. Potassium (K) is essential for plant growth and development, which has a significant effect on the protein synthesis, stomatal movement, enzyme activation, water relation and photosynthesis in plants (Marschner, 1995). K must be supplied to ensure satisfactory crop performance, yield and quality of crops. Researchers Hussain et al. (2015) found that potassium fertilization enhanced the nutrient uptake, growth parameters, physiological traits and nutrient uptake of corn plants significantly. Awad et al. (2014) stated that K was involved in controlling cell water content and photosynthetic activity. Furthermore, Zörb et al. (2014) said that K played a major role in sugar transport and starch accumulation in plants.

In general, as the K doses were increased there was an increase in N, P and K uptake. The highest N, P and K nutrient uptake was found in the order of high doses (200 kg ha^{-1}), medium doses (100 kg ha^{-1}), and no fertilizers (0 kg ha^{-1}). The nitrogen, phosphorous and potassium uptake also depends on plant factors, including genotypes and developmental stage such as vegetative versus reproductive stages (Rengel and Damon, 2008). Nitrogen, phosphorous and potassium play a vital role in many physiological processes such as photosynthesis, activation of enzymes, flavour, carbohydrate transport, regulation of stomata, protein formation, and water use efficiency (Fageria, 2001; Fageria and Moreira, 2011; Wang et al., 2009).

Interaction enriched compost with 100 kg ha^{-1} KCl was not significantly different from the enrichedd compost with 200 kg ha^{-1} KCl (Table 2), indicating that enriched compost required less KCl fertilizer as much as 100 kg ha^{-1} to produce sweet corn production. The experiment on peppers found that compost combined with low rates of fertiliser generally produced higher yields than other treatments (Roe et al., 1997). This is possible because, based on the analysis of nutrients, the content of K_2O in enriched paddy straw compost was sufficient. Plant responses to K fertilizers were influenced by the content of K in the soil and organic matter is the key to improving the productivity of soil and fertilizer efficiency. So in order to support the increase of the sweet corn yield, a combination of fertilizer and organic matter is required. Ortiz-Escobar and Hue (2011) reported that amending the soil with good-quality composts (characterized by low C/N ratio and high N, P, K, and micronutrients) is essential to provide adequate nutrients in organic farming. Makarim (2007) stated that rice straw contains several nutrients such as N, P, K, and S. Overall, it can be concluded that an appropriate nutrient supply, either organic or mineral, is crucial to reach high yields in sweet corn development.

This experiment revealed that organic enriched paddy straw compost and potassium fertilizer applications are very essential in enhancing the soil nutrient uptake and increasing the sweet corn yield. Futher research concerning combining with other fertilizers such as phosphorous fertilizers may be undertaken to explore the most appropriate combined compost and fertilizer for sweet corn cultivation in the tropics.

CONCLUSION

Organic enriched paddy straw compost and potassium fertilizer applications are very essential for enhancing soil nutrient uptake and increasing sweet corn yield. The vegetative growth, yield, and uptake of N, P, and K at recommended 100 kg K ha^{-1} combined with enriched paddy straw compost is advised. Therefore, we recommend the use of compost for sweet corn by utilizing material in situ such as straw paddy rice.

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