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GROWTH AND PRODUCTION OF SWEET CORN PLANTS (Zea mays saccharata. Strut) FROM THE EFFECT OF FERMENTATION OF SEVERAL MIXTURES OF PALM OIL MILL SOLID WASTE (LPKS) WITH COW SOLID (LTS)

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Abstract: *The research was carried out in Sei Mecirim Village Market 4 Sunggal District with an altitude of + 400 meters above sea level, Andosol soil type, the research will be carried out from July to September 2023. With the research title "Growth and production of sweet corn (Zea mays saccharata. Strut) From the Effect of Some Fermentation of Palm Oil Mill Solid Waste (LPKS) Mixture with Cow Solid Waste". This study used a non-factorial Group Randomized Design (RAK) with 5 mixed treatments of LPKS with LTS Cattle Waste were So (without LPKS and LTS), S1 (30% LPKS + 70% LTS), S2 (50% LPKS + 50% LTS), S3 (70% LPKS + 30% LTS), S4 (100% LPKS) and S5 (100% LTS) using 4 repeats and at a dose of 14 tons/ha. Based on the results of the research conducted differences in substitution have a real influence on the growth and production of sweet corn, To get the best growth and production, use 70% LPKS with 30 5*

INTRODUCTION

Background

Maize plants originated in the Americas and have been known thousands of years ago, eventually developing in Mexico, Central America, and South America, followed by Spain, Portugal, France, Italy, and northern parts of Africa. Residents of several regions in Indonesia (for example in Madura and Nusa Tenggara) also use corn as a staple food (Suprapto, 1999).

Sweet corn has long been known by the Indians, in America. This was proven when in 1779 Sullivar made an expedition against the Indians. On his way through the river, he found a field of sweet corn. By 1832, sweet corn had been widely grown in America. In Indonesia, sweet corn was first known in canned packaging from imported products. Sweet corn is cultivated widely after developing in supermarkets that accommodate many products (PS Writing Team, 1996).

Sweet corn contains relatively high levels of sugar and can be used as a food ingredient, as an additive to medicines, and as an animal feed ingredient (Harizammry, 2007).

Corn production in tropical Indonesia is still relatively low, one of the contributing factors is the soil factor which currently lacks available nutrients in the soil. The reduction of nutrient elements in the soil for planting is due to farmers' actions in using chemical fertilization and the use of pesticides that are not appropriate. To improve the condition of damaged soil, it is necessary to fertilize, especially using organic matter. The application of organic fertilizer is a fertilizer with fertilizer limitations that partially or completely consist of organic matter of plants or animals that through the engineering process are used to provide plant nutrients and can improve the physical, chemical, and biological properties of the soil (Suntoro, 2003).

Organic matter from animals that turn into organic fertilizer can be in the form of solid waste of cattle (cow dung). Waste from cow manure contains, a nutrient element that is very important for plants. One example is the use of immature manure causing plants to die (Soeminto and Bagyo, 1987).

The development of beef cattle farming in North Sumatra Province over the last 5 (five) years has experienced a fairly rapid increase in population with an average annual population increase of 10.37%. The total population of beef cattle in 2011 was 541,698 heads (Livestock Statistics, 2012). The manure production of an adult cow is as much as 4,000 kg and urine 1000 lt / year, so it has very potential to be used as a basic material for making organic fertilizer.

Palm oil mill waste and livestock waste generally can still be used as basic ingredients for organic fertilizer because it has a high organic matter content, to improve the quality of organic fertilizer from good waste by using bioactivators. Various types of bioactivators have existed to aid the fermentation process. Bioactivators contain lignolytic, hemicellulolytic, proteolytic, and nitrogen fixation non-symbiotic bacteria, serving to accelerate the decomposition of organic waste into organic fertilizer (Indriani, 2012).

Problem Formulation

Based on the above background, problems can be formulated:
The effectiveness of the combination of palm oil mill waste (LPKS) and cattle waste (LTS) fermented using bio-on plant growth and production.

Research Objectives

The purpose of this study was to determine the extent of the effectiveness of organic fertilizer by combining palm oil mill waste (LPKS) and Cattle Waste (LTS) using bio-activators to produce organic fertilizer for the growth and production of sweet corn plants.

Research hypothesis

It is suspected that there is an effect of substitution of organic fertilizer application of palm oil solid waste (LPKS) and cattle solid waste (LPTS) using bio-activators on the growth and production of sweet corn (Zea mays saccharata. Strut).

RESEARCH METHODS

The random design used in this study is a non-factorial Group Random Design (RAK) with 6 substitution treatments and 4 repeats, namely:
Substitution treatment Organic fertilizers used are:

Mixed LP-MCC and LTS	LPKS (%)	LTS (%)
S0	0	0
S1	70	30
S2	50	50
S3	30	70
S4	0	100
S5	100	0

Research Implementation

Palm oil solid waste material cattle solid waste and EM4 bioactivator. Making organic fertilizer with fermentation substitution (mixture) by the treatment added with EM4 bioactivator with a dose of 0.25% stirred until homogeneous. Then put into a barrel that is open on the barrel/drum, closed in an aerobic state, and left. The temperature it reaches 500C then stirred until the temperature decreases to 390Cthen left and closed for 3 weeks. The fermented results are ready to be applied to corn plants in the field.

The research field was cleared of weeds and other plant residues. Next, the soil is processed with a hoe 10-20cm deep, then the soil is harrowed so that the surface becomes flat and continued with making a plot.

The land is given organic basic fertilizer, solid waste of oil palm, and solid waste of cattle that have been fermented according to the treatment by running on the right and left of the plant as deep as 3cm with a planting distance of 50 cm x 20 cm. Sweet corn seeds are planted by the trial method by planting 2 seeds per planting hole. Plant embroidery is carried out a week after planting so that plant growth is not hampered and plant growth remains simultaneously. The plants that are replaced are dead plants and plants with abnormal growth.

Weeding sweet corn plants is carried out based on the condition of weeds around the plant by cleaning with a hoe and once again seasoning the stem. The first seasoning of sweet corn plants is carried out when the plants are 3 MST old. This aims to close the exposed roots and make plant growth upright or sturdy by raising/stockpiling the soil on the plant grass.

For pest and disease attacks, prevention is carried out by spraying beyond the economic threshold of pests that attack plants. For countermeasures, spraying is done as early as possible with the right dose, so that pests can be immediately overcome.

The type and dose of pesticides used in dealing with pests vary greatly depending on the pests controlled and the population level of these pests. Harvesting sweet corn is carried out during the phase of milk ripening and flour ripening or approximately 14-21 days after corn silk appears. The hair has blackish-brown and yellowed seeds that have fully developed to the tip of the cob and have the maximum size and condition of soft seeds filled with milky liquid

Observed parameters

Plant height (cm)

Measuring plant height starts from the bottom base to the tip of the longest leaf using a mer, to avoid confusion in making sample traces. Measurements were carried out 2MST with a measurement interval of once every 1 week until the sweet corn plants flowered.

Diameter Rod (cm)

The diameter of the rod is measured using measuring instruments. Observations were made after the plants were 21 days old, and measurements were carried out at intervals of once every 2 weeks until the sweet corn plants flowered.

Sample production (kg)

Production per sample is taken or harvested at the age of 70 days after planting, then weighed how much the weight of each sample the production of samples was clean from the field and the results were recorded.

Production per Ha (ton)

Production per plot is taken or harvested after planting, then it is weighed how much each plot weighs and the production of each plot is clean from the field production per plot is taken from all crops of each plot then the results are recorded.

RESULTS AND DISCUSSION

Results

The average results of observations made in the field in testing the substitution of several percentages of a mixture of palm oil mill waste (LPKS) with cattle waste (LTS) for growth from 3 mst to 6 mst and production at harvest. The average results of the treatment are analyzed statistically to obtain a Fingerprint List, if there is a noticeable difference proceed to the Duncan Multiple Range Test (DMRT).

The difference from the results of the analysis of each parameter tested can be seen in each parameter tested.

Plant Height (cm)

Observations for the height growth of corn plants were carried out 4 times starting from 3 mst to 6 mst flowers with an interval of 1 week. The results of observations with measurements obtained for each treatment and repeat of the effect of waste mixtures (LPKS and LTS) with the average can be seen in Table 1.

Each observational plant height growth (Table 1) obtained from several mixtures forming organic fertilizers since 3 and 4 mst showed no noticeable difference ($p > 0.05$). The increase in plant height from the influence of the percentage of the mixture was significantly different after the plants were 5 mst old and more clearly seen at 6 mst.

Table 1. The average height of corn plants (cm) from the effect of substitution of LPKS with LTS at 3 to 6 weeks after planting.

Treatment		Observation		
(%)	3 mst	4 mst	5 mst	6 mst
LPKS + LTS Mix				
S0 (00 + 00)	38.62^{a}	79.00^{a}	180.41^{c}	202.44^{c}
S1 (30 + 70)	45.60^{a}	93.07^{a}	231.11^{ab}	252.82^{ab}
S2 (50 + 50)	44.25^{a}	91.69^{a}	229.29^{ab}	249.46^{b}
S3 (70 + 30)	47.06^{a}	90.19^{a}	225.80^{ab}	246.00^{b}
S4 (100 + 00)	47.83^{a}	89.31^{a}	213.69^{bc}	239.34^{b}
S5 (00 + 100)	40.51^{a}	92.80^{a}	236.92^{a}	262.57^{a}

Description: The same letters in the same column differ insignificantly at the level of 5%

The average plant height at 6 MST showed the highest plant height produced with the use of 100% LTS (S5) on average 262.57 cm with no real difference ($p > 0.05$) to S1 treatment (a mixture of 30% LPKS and 70% LTS) with an average rate of 252.82 cm and very significantly different ($p < 0.01$) to S3, S4 and So. The So (control) treatment was the lowest plant height with a very noticeable difference ($p < 0.01$) to SS1, S2, S3, S4 and S5.

From this result, it can be seen that the less LPKS mixture while increasing the percentage of LT's mixture gives lower plant height growth. The difference in the height of sweet corn plants from the effect of treatment of several substitutions of LPKS mixture with LTS can be seen in Figure 1.

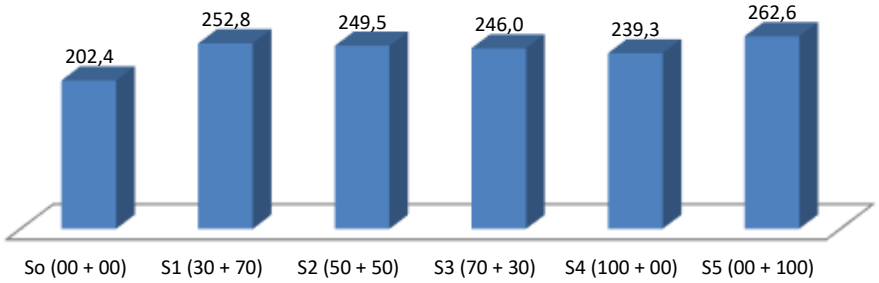


Figure 1. The average height of sweet corn plants from the influence of the percentage of LPKS mixture with LTS

Diameter Rod (cm)

The average diameter of corn plant stems was observed since the plants were 3, 4, and 5mst old from the effect of LPKS substitution with LTS based on fingerprint analysis showed no real difference ($p > 0.05$) in each observation. More details can be seen in Table 2. Based on the results of measuring the diameter of sweet corn plant stems and statistical analysis of the effect of the percentage of waste mixture (LP-PKS with LTS) there is a very noticeable difference ($p < 0.01$) after the plant is 6 weeks old. First, the rod diameter material from 3 MST increased to 6 MST, and the largest diameter of the effect of substitution of the waste mixture was 100% LTS (S5) with an average of 2.92 cm, with a real difference ($p < 0.05$) to all treatments tested, but very significantly different from S3 (70% LPKS + 30% LTS), S4 (100% LPKS) and So (without organic fertilizer as a control).

Table 2. Average Stem Diameter of corn plants (cm) from the effect of LPKS substitution with LTS at 3 to 6 weeks after planting.

Treatment		Observation		
(%)	3 mst	4 mst	5 mst	6 mst
LPKS + LTS Mix				
S0 (00 + 00)	0.45^{a}	0.90^{a}	1.71^{a}	2.56^{c}
S1 (30 + 70)	0.51^{a}	1.20^{a}	2.18^{a}	2.75^{b}
S2 (50 + 50)	0.50^{a}	1.15^{a}	2,07^{a}	2.70^{bc}
S3 (70 + 30)	0.55^{a}	1.11^{a}	1.99^{a}	2.65^{bc}
S4 (100 + 00)	0.53^{a}	1.06^{a}	2,01^{a}	2.58^{c}
S5 (00 + 100)	0.46^{a}	1.30^{a}	2.20^{a}	2.92^{a}

Description: The same letters in the same column differ insignificantly at the level of 5% Table 2 with the average diameter of the stem with the results of various fingerprints for planting sweet corn dalat using 100% LTS (S5) in planting in the field.

Production

The results of weighing young corn from the field from the effect of substitution of LPKS mixture with LTS with several percentages showed a very noticeable difference ($p < 0.01$) both for production/sample (g) and production/ha (ton). The data generated based on production weighing results (kg) can be seen in Table 3.

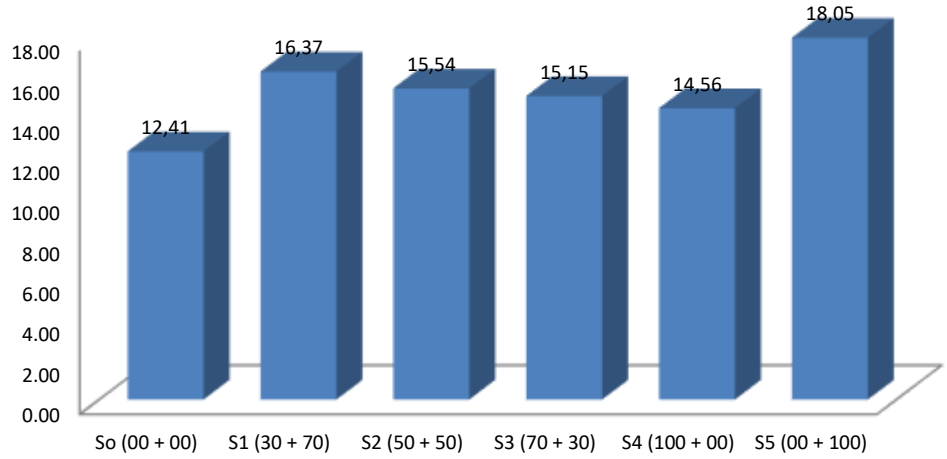
The highest production from the use of solid organic fertilizer substitution was produced by S5 treatment (100% LTS) with an average of 291.53 g / sample (18.05 tons/ha, with no real difference ($p > 0.05$) against S1 treatment (30 % LPKS + 70 % LTS), against S2 (50 % LPKS + 50 % LTS) and S3 treatment (70 % LPKS + 30 % LTS) respectively production of 16.37 tons, 15.54 tons and 15.15 tons (per ha) but very different ($p < 0.01$) to control (S0). Compared to treatment without fertilizer (S0) is the least production with an average of 199.94 g / sample (12.41 tons/ha) with no real difference ($p > 0.05$) to the treatment of S4, S3, S2, and S1, while against S5 shows a very real difference.

Table 5. Average production per sample (g) and tons per Ha (ton) and dosi effect of several percentages of waste mixture (LP-PKS and LTS) after harvest.

Treatment		Production	
(%)	g/sample		ton/Ha
LPKS + LTS Mix			
So (00 + 00)	199.94^{b}		12.41^{bB}
S1 (30 + 70)	264.18^{ab}		16.37^{a}
S2 (50 + 50)	250.69^{ab}		15.54^{ab}
S3 (70 + 30)	244.48^{ab}		15.15^{ab}
S4 (100 + 00)	234.82^{ab}		14.456^{ab}
S5 (00 + 100)	291.53^{a}		$18,05^{a}$

Description: Letters followed by the same letter in the same column showed no real difference at the 5% level based on Duncan's Multiple Range Test (DMRT).

Based on several percentages, a mixture of LPKS with LTS gives different results, and five treatments can be illustrated in Figure 2.



Based on several percentages, a mixture of LPKS with LTS gives different results, and five treatments can be illustrated in Figure 2.

Discussion

From observational data and statistical analysis results, it was obtained that the effect of mixed treatment of organic matter from LP-PKS with LTS had a real effect on plant height growth (cm), and production, but had no real effect on the growth of the number of leaves (strands), stem diameter (cm), number of cobs (stalks).

The effect was not noticeable on the number of leaves, stem diameter, and number of cobs/samples on corn plants, but the treatment of applying organic fertilizer to a mixture of fertilizers produced was not real $p > 0.05$. It can be seen that with the increasing number of applications of mixed organic fertilizers seen in the parameters of plant height, the length of the cob is getting higher. The effect of mixed organic fertilizers on different parameters is evident, it is suspected that the higher the percentage of material from LTS, the higher the availability of nutrients in the soil for use by corn plants.

The availability of nutrients in the soil through proper fertilization during plant growth and development results in the activation of plant roots causing additional nutrients, making nutrients be absorbed more from the soil. In this study it can be seen that a mixture of more and more organic matter from LTS responds better to the growth and production of sweet corn, this is to the results of research by Septia (2015) produces the highest growth and production of corn obtained using 100% cow dung and if less cow manure in the mixture then growth and production are reduced.

Lingga (2003) stated that the application of fertilizers containing more nutrients, especially N, needs to be done which is assessed based on the nutrient content of the fertilizer, concentration, and mixed organic fertilizer. Nyakpa, et al (1986), stated that in general, the nitrogen nutrient content in wet soils is 0.15%, and for dry soils is 0.12%.

Organic fertilizer by the percentage of the waste mixture in organic fertilizer can increase the activity of microorganisms, by helping in decomposing organic materials. As is known that this organic fertilizer is rich in microorganisms in the soil (Agricultural Research and Development Agency DEPTAN no. 048 / PH / 2009).

According to Hasibuan (2006), organic fertilizers have an important role such as increasing humus levels in the soil, and can prevent Al and Fe poisoning that react sourly. Decomposition of plant material and tiny bodies, soluble potassium re-enters the soil Nyakpa, et al (1986).

Organic fertilizer fertilizer mixture causes an influence on all observed parameters, this is because liquid compound fertilizer in the soil can add nutrients in the soil and is sufficient for the development of corn plants. If one factor is more dominant than other factors, then the other factor will be covered and not affect plants, Gomez and Gomez (1995).

The availability of nutrients in plants will vary in nutrients during growth and development is not the same, requiring different intervals with unequal amounts needed. Fertilizers should be applied when plants need them so that they produce better growth (Sutedjo & Karta Sapoetra, 1995).

Setiadi (2000) reported that one of the limiting factors in plant growth and development is the absorption of essential nutrients. In the process of plant growth in absorbing nutrients in the metabolic process, among others, cell growth that can be fulfilled, means the availability of food for growth is increasing. Plants experiencing a lack of elements will result in stunted fruit formation or no fruiting at all Sutedjo (2002). The use of fertilizer is an effort to increase the production of corn plants that have been cultivated, and farmers have considered fertilizer and fertilization methods as one of the things that cannot be separated in their farming activities (Anonim, 2007).

Based on the percentage of organic fertilizer mixture that is expected is the availability of certain elements in the mixture which is the availability of elements in growth, this is the opinion of Sutedjo (2002) states that nutrient needs for each phase of plant growth are different. The elements contained in the dosage of mixed organic fertilizer are indispensable for plants for growth and production. (Lingga, P., and Marsono. 2004; Anonymous, 2010).

The availability of nutrients including the element Potassium needed by plants. An experiment by Marsono (2001) and Samadi (1997) said that potassium plays a role in plant growth and development. The Plants that get enough potassium will be able to grow and cause better absorption of water and nutrients. Novizan (2002), states that potassium elements are needed from plants in the synthesis of proteins and carbohydrates and the translocation of carbohydrates more smoothly.

CONCLUSION

The use of 100% LTS organic fertilizer (5) provides the highest growth and production response, followed by 30% LPKS with 70% LTS (S1)

REFERENCE

[1] Anonimus., 1997. Teknik Bercocok Tanam Jagung. Kanisius. Yogyakarta.
[2] _____., 2010. Brosur Pupuk Hayati Majemuk Cair Bio-Extrim. CV. Bangkit Jaya Abadi, Jakarta.
[3] Aak. 1993. Teknik Bercocok Tanam Jagung. Kanisius. Jakarta. Bukit A. 2008. Pengaruh besar berat umbi Bibit dan Dosis pupuk KCl Terhadap Pertumbuhan dan Produksi Kentang (Solanum tuberosum L). Tesis Universitas Sumatera Utara (USU) Medan.

[4] Darwanto, S., 1984. Makalah Penelitian Daya Gabung Linier dari Lima Galur Murni Jagung. Institut Pertanian Bogor. Bogor.
[5] Dartius., 1993. Dasar – Dasar Fisiologi Tumbuhan. Fakultas Pertanian UMSU Medan.
[6] Dwidjoseputro,D. 1985. Pengantar Fisiologi Tumbuhan. Gramedia, Jakarta.
[7] Fisher, N.M. dan P.R. Goldsworthy, 1996. Jagung Tropik dalam Fisiologi Tnaman Budidaya Tropik. Fakultas Pertanian UGM. UGM Press. Yogyakarta.
[8] Foth, H. D. 1991. Dasar – Dasar Ilmu Tanah. Gadjah Mada University Press, Yokyakarta. Hal 361 dan 368.
[9] Ginting,S, Ginting,O, Tobing M.P.L dan R,K Damanik.1995.*Agronomi Tanaman Makanan I.*Medan.Fakultas Pertanian Universitas Sumatera Utara.
[10] Gomez, K.A. & A.A. Gomez. 1995. Prosedur Statistika untuk Penelitian Pertanian (Terjemahan A. Sjamsuddin & J.S. Baharsyah). Edisi Kedua. UI Press, Jakarta.
[11] Hasyim, H. 1995. Bercocok Tanam Jagung. Fakultas Pertanian UISU – UMSU. Medan.
[12] Hasudungan Sitorus 2008. Uji efektifitas pupuk organic padat dan NPK terhadap pertumbuhan dan produksi tanaman jagung hibrida (Sweet boy). Zea mays. Departemen Budi Daya Pertanian. Fakultas Pertanian USU Medan
[13] Koswara, J. Budidaya Jagung Manis (Zea mays saccharata. Strut). Bahan kursus Budidaya Jagung Manis dan Jagung Merah, (Bogor:Fakultas Pertanian IPB,1986)
[14] Leonard, W.H and J.H. Martin, Cereal Crops, (New York: The Macmillan publ.CO.Inc,1963) Mul mulyani sutedjo,2008. ”Pupuk Organik”.Penebar Swadaya,Jakarta.
[15] Lingga P. 2003. Petunjuk Penggunaan pupuk. Penebar Swadaya Jakarta.
[16] Novizan. 2002. Petunjuk Pemupukan yang Efektif. Agromedia ustaka, Jakarta.
[17] Nyakpa, M.Y., A.M. Lubis., Pulung., A.G. Amrah., A. Munawar., G.B. Hong., dan N. Hakim., 1988. Kesuburan Tanah. UNILA, Lampung.
[18] Poerwowidodo. 1992. Telaah Kesuburan Tanah. Angkasa, Bandung
[19] Purwono dan Hartono., 2005. Bertanam Jagung Unggul. Penebar Swadaya. Jakarta.
[20] Rukmana, 1997. Usaha Tani Jagung. Kanisius. Yogyakarta.
[21] Rahmat Rukmana.1992.”Menggapai Era Swasembada Jagung Nasional”.Dalam : Suara Karya,20 oktober 1992.
[22] Rinsema, W.I. 1986. Pupuk dan Pemupukan Bharata Karya Angkasa Jakarta.
[23] Saptariani, N., E. Widiyanti, L. Sari. 1990. Membuat Tanaman Cepat Berbuah, Penebar Swadaya, Jakarta.
[24] Sarief, S. 1985. Kesuburan dan Pemupukan Tanah Pertanian. Pustaka Buana. Jakarta.
[25] Stell, R, G, D. Dan J. H.Torrie. 1993. *Prinsip Dan Prosedur Statistika (Pendekatan Biometrik)* Penerjemah B Sumantri. Jakarta. Gramedia Pustaka Utama.
[26] Suntoro,”Peranan Bahan Organik terhadap Kesuburan Tanah dan, Pengelolaanya”, Orasi Guru Besar, Universitas Sebelas Maret,2003)
[27] Setia N.A.W., Nurul A and N. Herlin. 2015. Effect of organic Fertilizer on Growth and Yield of Sweet Corn (Zea mays saccharata) in Tercropping With Kangkung (Ipomoea reptans). urnal Produksi Tanaman, Volume 3, Nomor 2 Maret 2015, hlm. 141-148
[28] Setiadi dan Surya Fittri N, 2000, Kentang dan Pembudidayaan, Penebar Swadaya, Jakarta.
[29] Subandi, 1988. Jagung. Balai Penelitian dan Pengembangan Pertanian. Bogor.
[30] Suprapto, H.S, 1996. Bertanam Jagung. Swadaya. Jakarta.

[31] Sutedjo, M.M., 2002. Pupuk Dan Cara Pemupukan. Rineka Cipta. Jakarta.
[32] Tobing, M.P.L., R.K. Damanik, Opor Ginting, Sabar Ginting, 1995. Diktat Agronomi Tanaman Makanan. Fakultas Pertanian Universitas Sumatera Utara.. Medan.
[33] Tim Penulis Ps.1996"Sweet corn Baby corn".Penebar Swadaya, Jakarta.

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