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Application of manure and NPK fertilizer on Grobogan variety and Aochi/W-C-6-62 soybean as promise line in lowland Vertisol Ngawi, Indonesia

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Abstract. *Kuntyastuti H, Lestari SAD. 2017. Application of manure and NPK fertilizer on Grobogan variety and Aochi/W-C-6-62 soybean as promise line in lowland Vertisol Ngawi, Indonesia. Nusantara Bioscience 9: 120-125.* The effort to increase the productivity and production of soybean in lowland can be done with application of organic and/or inorganic fertilizer combined with promise line or large seed size soybean varieties that have high yield potential. Application of manure can increase soybean seed yield, but it needs a very high dose of more than 10 t manure/ha, so that often inhibits the supply, transportation, and application. The objective of this research was to evaluate the application of manure and NPK fertilizer on large seed size soybean which is Grobogan variety and Aochi/W-C-6-62 soybean as promise line in lowland Vertisol. The research was conducted in lowland Vertisol Ngawi on dry season (DS) 2011. The experiment used factorial randomized complete block design with three replications. The first factor was four doses of manure and the second factor was four doses combination of NPK fertilizer. The result showed that, on Vertisol soil Ngawi, Grobogan variety soybean need 2.5 t manure/ha to increase yield from 1.65 t/ha to 1.84 t/ha. To get a high yield of Aochi/W-C-6-62 soybean as promise line, there is two options fertilization. Aochi/W-C-6-62 need 7.5 t manure/ha to increase yield from 1.76 t/ha to 2.05 t/ha without inorganic fertilizer. Aochi/W-C-6-62 need 50 kg ZA + 150 kg SP-36 + 50 kg KCl/ha, but does not require additional manure to achieve 2.05 t/ha.

Keywords: Aochi/W-C-6-62, Grobogan variety, inorganic fertilizer

INTRODUCTION

The soil commonly quality depends on the response of soil to different land use systems and management practices that may often modify the soil properties and hence soil productivity (Gurumurthy et al. 2009). In the long term, the intensive utilization of lowland will decrease soil productivity and environmental quality. The use of high input of agrochemical substances will precisely decrease soil nutrients and produce the negative impact for the environment (Wihardjaka and Abdurachman 2007). Indeed the dependency on inorganic fertilizers instead of organic fertilizers for crop production is increasing day by day, resulting in the reduction of soil fertility (Roy et al. 2016).

Fertilizer is considered to be one of the main inputs for increasing crop growth and crop yields, but balanced of fertilization is the key to efficient fertilizer use for sustainable high yield (Hossain et al. 2002; Manna et al. 2005; Chakrabarty et al. 2014). The intensive use of high level of inorganic fertilizers has led to soil degradation, environmental pollution, the leveling of crop productivity (Kasryno and Haryono 2012), and in the worst case, soil nutrients drop below critical levels, causing land become infertile and then abandoned (McArthur and McCord 2014). Research has shown that application of manure significantly has an impact on physical, chemical, and biological properties of soil (Shirani et al. 2002; Bakayoko et al. 2009; Liang et al. 2011). Several studies showed that the application of organic fertilizer, especially manure, could increase the soil org-P fraction (Reddy et al. 2000), soil organic matter, N use efficiency and yield (Xu et al. 2008), the availability of C and soil microbial activity (Manna et al. 2007), increased infiltration (Risse et al. 2008), increased water holding capacity (Liang et al. 2011; Salahin et al. 2011; Rasoulzadeh and Yaghoubi 2010), improving fertility in tropical soil (Kihanda et al. 2007), and reduced compaction and erosion (Salahin et al. 2011).

Wheat grain yield was recorded highest (1104 kg/ha) with the application of the inorganic fertilizers (NPK 25-50-50 kg/ha). Among organic nutrient a source, 3.5 poultry manure t/ha was found the best. Number of pods, number of seeds per pod, and 1000 grain weight were higher in inorganic fertilizer treatment (Naeem et al. 2006). The application of organic matter was reported to fix the soil pH in some acid soils. The application of organic matter increased soil pH from 5.0 to 6.5 after 90 days of application (Evelyn et al. 2004; Suryantini 2007; Suryantini 2014). The application of di-ammonium phosphate at 124 kg along with 10 t/ha chicken manure obtained the maximum grain yield (Abbas et al. 2011).

To fulfill the nutrient demand of the crop, additional input is necessary and it can be supplemented with manure and inorganic fertilizers. Therefore, this experiment was aimed to evaluate the application of manure and NPK fertilizer on large seed size soybean which is Grobogan variety and Aochi/W-C-6-62 in lowland Vertisol soil Ngawi, East Java, Indonesia.

MATERIALS AND METHODS

The research was conducted at lowland Vertisol Wonokerto village, Kedunggalar sub-district, Ngawi district, East Java province during the dry season (DS) of 2011. The soybean seed used in this research were Grobogan variety and Aochi/W-C-6-62 soybean as promised line. The design was factorial randomized complete block design with three replications. The first factor were four doses of manure, namely (i) without manure; (ii) 2.5; (iii) 5.0; and (iv) 7.5 kg manure/ha. The second factor were four doses combination of NPK fertilizer, namely (i) without fertilizer; (ii) 50 kg ZA + 150 kg SP36 + 50 kg KCl; (iii) 100 kg ZA + 150 kg SP36 + 100 kg KCl; and (iv) 100 kg ZA + 300 kg SP36 + 100 kg KCl/ha.

Soybean seeds mixed with 350 g/L tiametoksam insecticide, was shown with two seeds per hole on a plot size of 4 m by 4.5 m with 40 cm and 15 cm intra-row spacing. Weeding, pest, and disease control conducted according to the plant conditions. The plant was harvested at physiological maturity. Observation consisted of chemical and physical properties of soil before planting with a density of 0-20 cm, manure analysis, NPK nutrient uptake at 40 DAS (day after sowing), yield component from 2.4 m x 3.6 m harvesting plot, and seed yield.

RESULTS AND DISCUSSION

Soil properties

Vertisol soil Ngawi has clay texture (clay fraction content 87%), soil porosity of 61%, and water holding capacity 34% (Table 1). High of clay fraction content caused saturated hydraulic conductivity (water flow in saturated conditions) is very slow, only 0.1 cm/hour. However, the high water holding capacity of soil to guarantee the crops need water and facilitate the uptake of nutrients. The negative impact of high clay content to water flow rate can be improved by making the seedbed width of 2-3 m.

The soil in location research is neutral (pH H_2O 6.94), that means the availability of macro-nutrients content was maximal. According to Syers et al. (2001) that the pH of Vertisol soil is usually neutral to alkaline. When macro-nutrients content in the ground is high, so the soil is able to fulfill then nutrient needs of the soybean plant. Table 1 showed in Vertisol soil Ngawi is poor of N, K, and S nutrient content. The use of this land for agriculture should pay attention to high cation content of Ca^{++} and Mg^{++}, as well as water management to prevent soil from dry conditions (Prasetyo 2007). The high of Ca nutrient content in the ground (36 me Ca/100 g) could obstruct the availability and nutrient content uptake of P and K.

Manure quality

The result of manure analysis indicated that the nutrient content was alkaline. Manure nutrient content P>Ca>K>Mg>Na>SO_4>N (Table 2). C/N ratio <10 as an indication of nutrient content in manure be able quickly used with soybean plant.

Lowland Vertisol Ngawi has clay textured and at the time of planting is still rain. As a consequence, the soil is wet, slippery, sticky, and rather difficult to create a drainage channel. In such conditions, the planting activities should be undertaken in order not to fall behind by farmers around the site with an unfavorable impact on the growth of soybean plants. Grobogan soybean seeds and Aochi/W-C-6-62 soybean promise line found to germination and grow well.

Treatment 2.5-7.5 t/ha manure affected the germination of Grobogan variety soybean. The germination of Grobogan variety soybean increased 13-20% to 71-77% because application 2.5-7.5 t manure/ha with created a line beside plant at planting time (Table 3). Conversely, fertilization of 100 kg ZA + 150 kg SP-36 + 100 kg KCl/ha and 100 kg ZA + 300 kg SP-36 + 100 kg KCl/ha with created a line beside plant at planting time, show the negative impact to the germination. The germination of Grobogan variety soybean reduced from 75.4% in the control treatment be 63.3-67.5% (reduced 8-12%).

Application 2.5-7.5 t/ha manure did not affect the root dry weight, shoot dry weight, and plant height at harvest. The average of root dry weight, shoot dry weight, and plant height of soybean respectively 1.48 g/plant, 11.08 g/plant, and 39 cm.

The growth of Grobogan variety soybean and Aochi/W-C-6-62 soybean promise line is quite good in lowland Vertisol soil Ngawi, because the availability of irrigation, which is sufficient the water needs of crops. Water for irrigation comes from rain and underground water is being pumped, and then distributed to field through plastic pipes to reduce water loss. In dry conditions, Vertisol soil broke and chunk in the surface ("*cracking*") with a depth of up to 1 m. As a result, irrigation takes a long time, so that need the high cost when water is pumped from the ground.

Grobogan variety soybean is one of large seed size variety soybean with early maturity. At the age 28 DAS, the plant has reached the phase of flowering with good vegetative growth. The plant has formed a pod at the time of sampling for analysis of plant nutrient content uptake at age 40 DAS. No crops canopy covers each other, so that not blocked the penetration of sunlight to the ground. Plants do not appear too high with a sturdy stem.

The results of the analysis of Grobogan variety soybean at 40 DAS showed that manure application with highest doses (7.5 t/ha) decreased the absorption of N and P nutrient uptake. Nutrient uptake of N and P decreased 13% and 18% compared to the treatment without manure (Table 4). K nutrients content uptake relatively unaffected with the application of manure. However, K nutrient content uptake was the lowest element, namely 0.165 g K/plants obtained at treatment without inorganic fertilizer.

Application of manure and inorganic fertilizer did not affect the number of branches, number of filled pod of Grobogan variety soybean, and soil penetration at harvest time in lowland Vertisol Ngawi. Number of branches and filled pods are 1.5 branch/plant and 30 filled pods/plant (Table 5).

Table 1. Chemical and physical properties of soil on Vertisol Ngawi before planting, DS 2011

Properties	Value
Chemical properties	
pH H_2O	6.94
pH KCl	5.83
Total N (%)	0.10
C-organic (%)	1.14
Available P (ppm P_2O_5)	71.0
SO_4 (ppm)	32.1
Exchangeable K (me/100 g)	0.17
Exchangeable Na (me/100 g)	0.24
Exchangeable Ca (me/100 g)	36.14
Exchangeable Mg (me/100 g)	5.07
CEC (me/100 g)	87.5
Fe (ppm)	25.45
Mn (ppm)	42.13
Cu (ppm)	12.17
Zn (ppm)	3.35
Physical properties	
Khj (cm/hour)	0.1
Content weight (g/cm^3)	1.0
Density (g/cm^3)	2.6
Porosity (%)	61.1
Water content pF 2.5 (%)	56
Water content pF 4.2 (%)	22
Water holding capacity (%)	34
Sand fraction (%)	3
Dust fraction (%)	10
Clay fraction (%)	87
Texture classes	Clay

Table 2. Chicken manure nutrient content, DS 2011

Chemical properties	Chicken manure	Chemical properties	Chicken manure
pH H_2O	8.18	K (%)	1.00
Total N (%)	0.20	Na (%)	0.36
C-organic (%)	4.90	Ca (%)	5.97
P_2O_5 Bray-1 (%)	7.17	Mg (%)	0.80
SO_4 (%)	0.32	CEC (me/100 g)	41.3

Table 3. The effects of fertilizer on germination, root dry weight, shoot dry weight, and plant height at harvest on Grobogan variety soybean in Vertisol soil Ngawi, DS 2011

Treatment	Germination (%)	Root dry weight 40 DAS (g/plant)	Shoot dry weight 40 DAS (g/plant)	Plant height at harvest (cm)
Manure (t/ha)				
0	57.9 b	1.50 a	10.72 a	39.0 a
2.5	70.9 a	1.55 a	11.11 a	37.4 a
5.0	77.4 a	1.42 a	10.98 a	39.5 a
7.5	73.0 a	1.43 a	11.50 a	40.1 a
ZA + SP-36 + KCl (kg/ha)				
0 + 0 + 0	75.4 a	1.63 a	11.67 a	40.2 a
50 + 150 + 50	73.0 ab	1.40 a	11.16 a	38.7 a
100 + 150 + 100	67.5 bc	1.36 a	10.71 a	39.5 a
100 + 300 + 100	63.3 c	1.50 a	10.77 a	37.6 a
Means	69.8	1.48	11.08	39.0
Interaction	ns	ns	ns	ns
CV (%)	12.85	9.31	17.57	11.83

Note: Numbers followed by different letters in a column were significantly different (P<0.05) using LSD test; DAS (day after sowing)

Table 4. The effects of manure and inorganic fertilizer on NPK nutrient content uptake on Grobogan variety soybean 40 DAS in Vertisol soil Ngawi, DS 2011

Treatment	N (g/plant)	P (g/plant)	K (g/plant)
Manure (t/ha)			
0	0.380	0.033	0.181
2.5	0.358	0.029	0.172
5.0	0.363	0.030	0.180
7.5	0.330	0.027	0.176
ZA + SP-36 + KCl (kg/ha)			
0 + 0 + 0	0.362	0.030	0.165
50 + 150 + 50	0.368	0.028	0.178
100 + 150 + 100	0.342	0.029	0.188
100 + 300 + 100	0.358	0.031	0.177
Means	0.358	0.030	0.177

Note: DAS (day after sowing)

Vertisol soil surface depth of 0-5 cm at harvest time is very hard. Measurement using a penetrometer provides the average rate of 3.97 kg/cm^2. High clay content in Vertisol soil Ngawi causes the soil to harden and solid when dry. Conversely, when wet, the soil become slippery and sticky. Nevertheless, Grobogan variety soybean seed can germinate with average germination of 70% and result in plant population at harvest time as much as 208000 plants/ha.

At the beginning, application manure increased the seed germination of Grobogan variety soybean di Vertisol soil Ngawi. Instead at the end, application manure does not affect the plant population at harvest time, 100 seeds weight, and seed weight/plant (Table 6). Grobogan variety soybean is the superior large seed size. At Vertisol soil Ngawi, the average 100 seeds weight reached 21.73 g and seed weight/plant 6.86 g. Application inorganic fertilizer does not affect the growth component, yield component, and yield of Grobogan variety soybean. Same case with application manure, but application 2.5 t manure/ha with created a line beside plant at planting time increase Grobogan variety soybean yield from 1.97 t/ha (without manure) to 2.23 t/ha, increase 13%.

Different information obtained of Aochi/W-C-6-62 soybean promise line in Vertisol soil Ngawi. Application manure and inorganic fertilizer does not affect the germination, root and shoot dry weight 40 DAS, plant height, branch number/plant, filled pod number/plant, and

soil penetration. Seed germination is good, average 89% (Table 7 and 8). However, soybean can grow and develop much better in lowland Vertisol Ngawi.

Roots and canopy of Aochi/W-C-6-62 soybean promise line can grow up to a dry weight 1.40 g/plant and 9.43 g/plant, higher 97% and 59% compared in Alfisol soil Probolinggo. The optimal growth allows the soybean reached a height 58 cm with 2.2 branches/plant, 30 filled pods/plant, and without empty pods. In contrast to the soil penetration after Grobogan variety soybean harvest time was worth 3.97 kg/cm^2, after Aochi/W-C-6-62 soybean promise line harvest time, soil penetration was 1.70 kg/cm^2.

Aochi/W-C-6-62 soybean promise line assembled for the purpose large seed size, medium maturity with high yield potential. In lowland Vertisol Ngawi on DS-2 2011, that soybean promise lines reached a vegetative stage at the age 28 DAS, while Grobogan variety soybean has flowered. At the age 39 DAS, Aochi/W-C-6-62 soybean promise line start flowering, otherwise, Grobogan variety soybean has filled pod. Aochi/W-C-6-62 soybean promise line canopy has been close, width leaves, intact, and not attacked by pest or diseases.

In general, Aochi/W-C-6-62 soybean promises line growth in Vertisol Ngawi better than Grobogan variety soybean. The growth differentials have also impacted on the NPK nutrient content uptake at age 40 DAS. The average NPK nutrient content uptake of Grobogan variety soybean successively 0.358 g N/plant, 0.030 g P/plant, and 0.177 g K/plant (Table 4). The average NPK nutrient content uptake of Aochi/W-C-6-62 soybean promise lines was higher, respectively 0.401 g N/plant, 0.033 g P/plant, and 0.192 g K/plant (Table 9). The highest NPK nutrient content uptake, respectively, 0.443 g N/plant, 0.036 g P/plant, and 0.215 g K/plant obtained by application 2.5 t manure/ha.

Leaf of Aochi/W-C-6-62 soybean promise lines starts to turn yellow when Grobogan variety soybean was harvesting. Aochi/W-C-6-62 soybean promise line achieve full plant population with a plant spacing of 40 cm x 15 cm, 2 plants/holes, which are 329000 plants/ha (Table 10). In the full population, Aochi/W-C-6-62 soybean promise line reached average productivity of 2.65 t/ha. Application inorganic fertilizer did not affect the seed yield. Instead, application 5.0 t manure/ha increased the soybean yield of 2.42 t/ha (without manure) to 2.80 t/ha, increase of 0.38 t/ha (16%). Application manure and inorganic fertilizer did not affect 100 seeds weight and seed weight/plant, average 15.75 g/100 seeds and 10.02 g/plant (Table 10).

Interaction of manure and inorganic fertilizer of Aochi/W-C-6-62 soybean promise line showed that application 7.5 t manure/ha with 100 ZA + 200 SP-36 + 100 KCl kg/ha obtain the highest seed yield. Aochi/W-C-6-62 soybean promise line requires 7.5 t manures/ha to increase the seed yield of 1.87 t/ha to 2.02 t/ha (Table 11). Several researchers have recommended integrated soil fertility management options for increasing agronomic efficiency of applied inputs. The integrated soil fertility management practices comprise the use of organic and inorganic resources in an integrated manner in order to maximize their use efficiency and crop productivity (Sanginga and Woomer 2009; Vanlauwe et al. 2010).

Table 5. The effects of manure and inorganic fertilizer on branch number, filled pod number, and soil penetration on Grobogan variety soybean 40 DAS in Vertisol soil Ngawi, DS 2011

Treatment	Branch no./plant	Filled pod no./plant	Soil penetration (kg/cm^2)
Manure (t/ha)			
0	1.5 a	30.9 a	4.16 a
2.5	1.4 a	29.8 a	3.81 a
5.0	1.5 a	29.7 a	3.89 a
7.5	1.5 a	29.2 a	4.02 a
ZA + SP-36 + KCl (kg/ha)			
0 + 0 + 0	1.4 a	30.0 a	4.23 a
50 + 150 + 50	1.3 a	28.9 a	3.93 a
100 + 150 + 100	1.7 a	31.2 a	3.90 a
100 + 300 + 100	1.5 a	29.4 a	3.82 a
Means	1.5	29.9	3.97
Interaction	*	ns	ns
CV (%)	10.33	8.11	17.04

Note: Numbers followed by different letters in a column were significantly different (P<0.05) using LSD test; DAS (day after sowing)

Table 6. The effects of manure and inorganic fertilizer on plant population, seed yield, 100 seeds weight, and seed weight on Grobogan variety soybean in Vertisol soil Ngawi, DS 2011

Treatment	Plant pop. /ha	Seed yield (t/ha) of moisture content 12 %	100 seeds weight (g)	Seed weight (g/plant)
Manure (t/ha)				
0	204765 a	1.65 b	21.66 a	7.03 a
2.5	211227 a	1.84 a	21.96 a	7.12 a
5.0	193673 a	1.86 a	21.64 a	6.51 a
7.5	223090 a	1.84 a	21.65 a	6.77 a
ZA + SP-36 + KCl (kg/ha)				
0 + 0 + 0	224151 a	1.81 a	21.62 a	7.08 a
50 + 150 + 50	207465 a	1.88 a	21.60 a	6.73 a
100 + 150 + 100	196373 a	1.77 a	21.91 a	6.88 a
100 + 300 + 100	204765 a	1.73 a	21.79 a	6.74 a
Means	208089	1.80	21.73	6.86
Interaction	ns	ns	ns	ns
CV (%)	16.91	12.23	2.62	6.42

Note: Numbers followed by different letters in a column were significantly different (P<0.05) using LSD test

Table 7. The effects of fertilizer on germination, root dry weight, shoot dry weight, and plant height at harvest on Aochi/W-C-6-62 soybean promise line in Vertisol soil Ngawi, DS 2011

Treatment	Germination (%)	Root dry weight 40 DAS (g/plant)	Shoot dry weight 40 DAS (g/plant)	Plant height at harvest (cm)
Manure (t/ha)				
0	87.3 a	1.57 a	10.12 a	56.3 a
2.5	88.4 a	1.38 a	8.77 a	58.6 a
5.0	89.5 a	1.27 a	9.25 a	57.3 a
7.5	91.0 a	1.38 a	9.60 a	57.6 a
ZA + SP-36 + KCl (kg/ha)				
0 + 0 + 0	87.9 a	1.42 a	9.65 a	59.1 a
50 + 150 + 50	88.6 a	1.33 a	9.02 a	57.4 a
100 + 150 + 100	89.0 a	1.36 a	9.35 a	57.6 a
100 + 300 + 100	90.7 a	1.48 a	9.72 a	55.8 a
Means	89.1	1.40	9.43	57.5
Interaction	ns	ns	ns	ns
CV (%)	4.45	10.10	17.20	7.56

Note: Numbers followed by different letters in a column were significantly different (P<0.05) using LSD test;
DAS (day after sowing)

Table 8. The effects of manure and inorganic fertilizer on branch number, filled pod number, and soil penetration on Aochi/W-C-6-62 soybean promise line 40 DAS in Vertisol soil Ngawi, DS 2011

Treatment	Branch no./plant	Filled pod no./plant	Soil penetration (kg/cm^2)
Manure (t/ha)			
0	1.9 a	27.9 a	1.77 a
2.5	2.1 a	28.3 a	1.81 a
5.0	2.3 a	32.9 a	1.59 a
7.5	2.4 a	31.1 a	1.64 a
ZA + SP-36 + KCl (kg/ha)			
0 + 0 + 0	2.3 a	32.9 a	1.69 a
50 + 150 + 50	2.2 a	29.6 a	1.70 a
100 + 150 + 100	2.3 a	30.2 a	1.70 a
100 + 300 + 100	1.9 a	27.5 a	1.63 a
Means	2.2	30.0	1.70
Interaction	ns	ns	ns
CV (%)	14.48	16.53	5.99

Note: Numbers followed by different letters in a column were significantly different (P<0.05) using LSD test

On Vertisol soil Ngawi: (i) Grobogan variety soybean need 2.5 t manure/ha for increasing yield from 1.65 t/ha to 1.84 t/ha. (ii) To get high yield of Aochi/W-C-6-62 soybean as promise line, there is two options fertilization. Aochi/W-C-6-62 need 7.5 t manure/ha for increasing yield from 1.76 t/ha to 2.05 t/ha without inorganic fertilizer. Aochi/W-C-6-62 need 50 kg ZA + 150 kg SP-36 + 50 kg KCl/ha, but does not require additional manure to achieve 2.05 t/ha.

Table 9. The effects of manure and inorganic fertilizer on NPK nutrient content uptake on Aochi/W-C-6-62 soybean promise lines 40 DAS in Vertisol soil Ngawi, DS 2011

Treatment	N (g/plant)	P (g/plant)	K (g/plant)
Manure (t/ha)			
0	0.391	0.029	0.206
2.5	0.443	0.036	0.215
5.0	0.373	0.035	0.176
7.5	0.397	0.033	0.172
ZA + SP-36 + KCl (kg/ha)			
0 + 0 + 0	0.396	0.035	0.199
50 + 150 + 50	0.405	0.034	0.195
100 + 150 + 100	0.411	0.032	0.193
100 + 300 + 100	0.391	0.032	0.181
Means	0.401	0.033	0.192

Table 10. The effects of manure and inorganic fertilizer on plant population, seed yield, 100 seeds weight, and seed weight on Aochi/W-C-6-62 soybean promise line in Vertisol soil Ngawi, DS 2011

Treatment	Plant pop. /ha	Seed yield (t/ha) of moisture content 12 %	100 seeds weight (g)	Seed weight (g/plant)
Manure (t/ha)				
0	318576 a	1.87 b	15.47 a	9.96 a
2.5	335262 a	1.94 b	15.93 a	9.35 a
5.0	337577 a	1.94 b	15.90 a	10.21 a
7.5	326389 a	2.02 a	15.70 a	10.96 a
ZA + SP-36 + KCl (kg/ha)				
0 + 0 + 0	330343 a	1.92 a	15.77 a	10.64 a
50 + 150 + 50	331597 a	1.97 a	15.73 a	10.74 a
100 + 150 + 100	331699 a	1.94 a	15.76 a	9.45 a
100 + 300 + 100	324171 a	1.93 a	15.75 a	9.25 a
Means	329451	1.94	15.75	10.02
Interaction	ns	*	ns	ns
CV (%)	9.19	13.32	3.62	18.01

Note: Numbers followed by different letters in a column were significantly different (P<0.05) using LSD test

Table 11. Interaction of manure and inorganic fertilizer on seed yield on Aochi/W-C-6-62 soybean promise line in Vertisol soil Ngawi, DS 2011

Seed yield (t/ha) of moisture content 12 %					
Manure (t/ha)	**ZA + SP-36 + KCl (kg/ha)**				**Means**
	0	**50 + 150 + 50**	**100 + 150 + 100**	**100 + 300 + 100**	
0	1.76 d	2.05 ab	1.84 cd	1.84 cd	1.87 B
2.5	1.99 abc	1.99 abc	1.84 cd	1.92 abcd	1.94 AB
5.0	1.88abcd	1.94 abcd	2.06 ab	1.87 bcd	1.94 AB
7.5	2.05 ab	1.91 abcd	2.02 ab	2.08 a	2.02 A
Means	1.92 P	1.97 P	1.94 P	1.94 P	1.94
CV (%)	13.32				

Note: Numbers followed by different letters in a column were significantly different (P<0.05) using LSD test

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