

## Short Communication: Effect of organic and inorganic fertilizers application on the early-medium maturing soybean yield

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**Abstract.** Lestari SAD, Sutrisno, Kuntastyuti H. 2017. Short Communication: Effect of organic and inorganic fertilizers application on the early-medium maturing soybean yield. *Nusantara Bioscience* 10: 1-5. Efforts to increase soybean productivity can be made with the application of organic and inorganic fertilizers. Large amounts of organic fertilizer are required to give a positive impact on soybean yield. However, this practice is deemed inefficient in terms procurement and transportation, making farmers less interested. The addition of inorganic fertilizer or the use of nutrient-rich organic fertilizer (Santap NM2) is among the solutions. The objective of this research was to formulate management techniques for organic and inorganic fertilizers application on the early-medium maturing soybean line, Lokal Jateng/Sinabung-1036, to achieve the soybean's maximum potential yield. The research was conducted on Alfisols at Muneng Research Station, Probolinggo, and Vertisols at Ngale Research Station, Ngawi, in the dry season of 2012. The experiment was performed in a randomized complete block design with factorial, with three replications. The first factor was four doses of organic fertilizer and the second factor was four combination doses of ZA, SP-36, and KCl fertilizers. On the Alfisols of Probolinggo, Lokal Jateng/Sinabung-1036 soybean did not require additional inorganic fertilizers to achieve a yield of 2.71 t/ha, whereas on the Vertisols of Ngawi, Lokal Jateng/Sinabung-1036 soybean need 2 t/ha Santap NM2 to increase its yield from 2.60 t/ha to 2.81 t/ha.

**Keywords:** Lokal Jateng/Sinabung-1036 soybean line, manure, Santap NM2

### INTRODUCTION

Soybean (*Glycine max* L. Merrill) is one of the important crops consumed by the Indonesian people. In 2012, Indonesian soybean production was 843.153 ton. In 2013, the production decreased by 63.161 ton to 779.992 ton, and in 2014, it increased again by 173.964 ton (FAOSTAT 2015). Current soybean production has not been able to keep up with the growing demand for soybean. Thus, it is necessary to find ways to increase the soybean production. Efforts to increase crop growth and yield can be made through the implementation of suitable cultivation technology (Kuntastyuti and Sutrisno 2017), one of which is the application of fertilizer. Balanced use of fertilizers is the key to achieve sustainable high crop yields (Hossain et al. 2002; Manna et al. 2005; Chakrabarty et al. 2014).

Several studies showed that the continuous application of inorganic fertilizer decrease the water-holding capacity, the organic matter and nutrient content, and the soil microbe population (Zhang et al. 2008; Zhang et al. 2010; Liu et al. 2013; Qin et al. 2015), which in turn decrease the quality of soil fertility. Soil fertility could be improved by the application of organic fertilizer such as manure. Manure could increase the soil water-holding capacity, soil organic matter, the plant N use efficiency, crop yield, as well as reduce the soil erosion (Rasoulzadeh and Yaghoubi 2010; Liang et al. 2011; Salahin et al. 2011).

Application of organic manure, in combination with recommended doses of chemical fertilizers, will result in better soybean yield and quality, as well as improve the soil

fertility status (Khaim et al. 2013). Mahesbabu et al. (2008) observed that the application of recommended dose of N, K, S in combination with 5 t/ha cow manure to soybean resulted in a yield of 2.24 t/ha. Yamika and Ikawati (2012) found that the combination of inorganic and organic fertilizers can increase the soybean yield up to 3.5 t/ha. Santap NM is a nutrient-rich organic fertilizer made of several raw materials that are abundantly available and easily obtained. Those raw materials are cow manure (47.5%), chicken manure (20%), rock phosphate (15%), boiler ash from sugar factory (15%), and sulfur (2.5%). The advantage of Santap NM application in soybean crops on non-acid land gives multiple benefits such as improving growth and seed yield, reducing the dependence on the inorganic fertilizer (up to 50%) (Iletri 2014). Applications of 1.5 t/ha Santap NM1 and 1.5 t/ha Santap NM2 on Vertisols were able to substitute the use of inorganic NPKS fertilizer Phonska up to 50%, which is equal to 150 kg of the fertilizer and gave the soybean a grain yield of 2.21-2.56 t/ha (Muzaiyanah et al. 2015).

Research on soybean response to organic and inorganic fertilizers have been done. However, a study on the response of early-medium maturing soybeans (Lokal Jateng/Sinabung-1036 soybean line) upon application of both fertilizers has not been done. The objective of this research was to formulate management techniques for organic and inorganic fertilizers application on the early-medium maturing soybean line, Lokal Jateng/Sinabung-1036, to achieve the soybean's maximum potential yield.

## MATERIALS AND METHODS

The research was conducted on Alfisols at Muneng Research Station, Probolinggo, East Java Province, Indonesia and Vertisols at Ngale Research Station, Ngawi, East Java Province, Indonesia, during the dry season (DS) of 2012. The soybean seed used in this research was Lokal Jateng/Sinabung-1036 soybean line (large seed). The experiment was performed in a randomized complete block design with two factors and three replications. The first factor was four doses of organic fertilizers and the second factor was four combination doses of ZA, SP-36, and KCl fertilizers (Table 1).

Soybean seeds treated with 350 g/l thiamethoxam insecticides were sown on 4 m x 4.5 m plots, with a spacing of 40 cm x 15 cm between plants. Each planting hole was filled with two plants without basic fertilizer application. Each treatment plot was separated by a channel (20 cm wide, 25 cm deep). In the Vertisols experiment, there was no tillage, whereas, in the Alfisols experiment, a tillage was performed. Weeding, pest, and disease control were conducted according to situations. The plant was harvested at 90 days after planting (DAP). Observations done in this study consisted of chemical and physical properties of soil before planting at a depth of 0-20 cm and 20-40 cm; organic fertilizer nutrient content; NPK nutrient content at 40 DAP; germination rate; root and shoot dry weight at 40 DAP; plant population; plant height at harvest; yield component from a 2.4 m x 3.6 m harvesting plot; and seed yield.

## RESULTS AND DISCUSSION

### Soil properties

The research was conducted on Alfisols of Probolinggo which has silty loam texture and on Vertisols of Ngawi with clay texture (Table 2). The saturated soil hydraulic conductivity value of the Alfisols was 3.61 cm/hour, while that of the Vertisols is 0.14 cm/hour. The low conductivity of the Vertisols is due to the soils high clay content (78%). Interestingly, the water-holding of both soils in their upper layer is almost the same, between 21-23%. Meanwhile, the porosity of the Vertisols (62%) is higher than that of the Alfisols (55%).

The Alfisols of Probolinggo is neutral (pH H<sub>2</sub>O 7.29), rich in N, P, K, Ca, and Mg, but poor in S. In neutral soils, the availability of macronutrients content was maximum's. The Vertisols of Ngawi also has a neutral pH; rich in P, K, Ca, and Mg; but poor in N and S. The pH of Vertisols is usually neutral to alkaline (Table 3). The high content of macronutrients in the soils sufficiently provides the nutrient requirement of soybean crops (Syers et al. 2001).

### Organic fertilizer properties

Santap NM2 is an acidic organic fertilizer rich in organic matter with N, P, K, and S elements. Santap NM2 has higher sulfate content (SO<sub>4</sub>) than the cow manure since its production involves a considerable use of sulfur

**Table 1.** First factor and second factor on the research, DS 2012

Factor I	Factor II
Without organic fertilizers	Without inorganic fertilizers
2.5 t/ha cow manure	50 kg ZA + 50 kg SP-36 + 100 kg KCl/ha
5 t/ha cow manure	50 kg ZA + 150 kg SP-36 + 50 kg KCl/ha
2 t/ha Santap NM2	50 kg ZA + 150 kg SP-36 + 100 kg KCl/ha

**Table 2.** Physical properties of Alfisols at Muneng Research Station, Probolinggo, East Java Province, Indonesia and Vertisols at Ngale Research Station, Ngawi, East Java Province, Indonesia (before the soybean planting)

Parameter	Alfisols		Vertisols	
	0-20 cm	20-40 cm	0-20 cm	20-40 cm
Khj (cm/hour)	3.61	3.41	0.14	0.17
Content weight (g/cm <sup>3</sup> )	1.09	1.18	0.99	0.98
Density (g/cm <sup>3</sup> )	2.43	2.40	2.60	2.60
Porosity (%)	55.1	50.8	61.9	62.3
Penetrate (kg/cm <sup>2</sup> )	7	10	4	3
Water content pF 2.5 (%)	34.9	27.1	57	58
Water content pF 4.2 (%)	12.5	12.9	36	32
Water holding capacity (%)	22.5	14.2	21	26
Sand fraction (%)	32	38	2	2
Silt fraction (%)	64	55	20	17
Clay fraction (%)	4	7	78	82
Texture classes	Silt loam	Silt loam	Clay	Clay

**Table 3.** Chemical properties of Alfisols at Muneng Research Station, Probolinggo, and Vertisols at Ngale Research Station, Ngawi (before the soybean planting)

Parameter	Alfisols		Vertisols	
	0-20 cm	20-40 cm	0-20 cm	20-40 cm
pH H <sub>2</sub> O	7.29	7.40	6.57	6.52
Total N (%)	0.56	0.36	0.123	0.115
C-organic (%)	1.20	0.87	2.26	0.97
Available P (ppm P <sub>2</sub> O <sub>5</sub> )	17.90	16.32	82.3	124.0
SO <sub>4</sub> (ppm)	21.23	15.43	45.36	55.41
Exchangeable K (me/100 g)	0.48	0.35	0.25	0.27
Exchangeable Na (me/100 g)	0.98	0.86	0.76	0.80
Exchangeable Ca (me/100 g)	21.35	19.77	6.66	3.36
Exchangeable Mg (me/100 g)	7.05	7.00	2.96	0.86
CEC (me/100 g)	19.91	19.46	66.6	9.74

**Table 4.** Organic fertilizers nutrient content

Chemical properties	Santap NM2	Cow manure
pH H <sub>2</sub> O	5.25	6.21
C-organic (%)	14.12	6.93
N-total (%)	2.49	2.07
P <sub>2</sub> O <sub>5</sub> total HNO <sub>3</sub> + HClO <sub>4</sub> (%)	6.19	0.32
SO <sub>4</sub> total HNO <sub>3</sub> + HClO <sub>4</sub> (%)	12.01	1.61
K total HNO <sub>3</sub> + HClO <sub>4</sub> (%)	1.61	0.70
Na total HNO <sub>3</sub> + HClO <sub>4</sub> (%)	0.90	0.40
Ca total HNO <sub>3</sub> + HClO <sub>4</sub> (%)	0.67	1.79
Mg total HNO <sub>3</sub> + HClO <sub>4</sub> (%)	0.35	0.61
Fe total HNO <sub>3</sub> + HClO <sub>4</sub> (%)	2.09	1.94
Zn total HNO <sub>3</sub> + HClO <sub>4</sub> (%)	0.06	0.01

(Harsono 2012). By contrast, the cow manure that we used in this research has a higher pH (Table 4) and is poor in organic material and N, P, K, and S content. The C/N ratio of both organic fertilizers is <10 as indicating that the nutrients in the manure are readily available for soybean plant.

### Alfisols experiments

The planting of Lokal Jateng/Sinabung-1036 soybean line in Alfisols Probolinggo were conducted at the end of February 2012. Soil processing was done during the time of planting when the soil condition was still a bit wet. The first irrigation was done after the planting. The germination percentage of Lokal Jateng/Sinabung-1036 soybean line in the field reaches 90%. Treatment of organic and inorganic fertilizers did not affect the soybean germination, root dry weight (40 DAP), shoot dry weight (40 DAP), and plant height at harvest (Table 5).

The early growth of Lokal Jateng/Sinabung-1036 soybean line was optimal. At 3 DAP, the soybean plants encountered a heavy rain accompanied by a tornado resulting in physical damage to the leaf (torn leaves). Nevertheless, the damage did not affect the further growth of the soybean. The soybean leaf canopy closes and the pods are well developed (full pod). The average of root and shoot dry weight is 0.63 g and 5.23 g, respectively, with an average plant height reaches 66 cm at harvest.

Application of inorganic fertilizers, ZA, SP-36, and KCl, did not affect the branch number, full pod number, and soil penetration resistance in the top layer. The average number of fully-developed pod per plant reached 46 pods. The average penetration resistance of the topsoil during harvest was 1.77 kg/cm<sup>2</sup>. Similarly, application of organic fertilizers especially Santap NM2 can increase the number of branches compared with that of without organic fertilizer (Table 6). Similar to the result of Zainal et al. (2014) found that application of 15 t/ha chicken manure and 50 kg/ha N can increase the number of branch per plant at 60 DAP. According to Miyasaka (2002), the increase in branch number is due to the availability of adequate fertilizer in the soil, allowing N to optimally stimulate overall growth, especially shoots, branches, and leaves.

Under optimal growth conditions, application of organic fertilizer can increase the N content but decrease the K content, while relatively has no effect on P content. Similarly, in this study, we found that Santap NM2 application increased the N content and at the same time decreased the K content of the soybean plant (Table 7). Muzaiyanah et al. (2015) found that the application of 2.5 t/ha Santap NM2 organic fertilizer on soybean resulted in higher N uptake in leaf (2.85%) compared with the control group, without fertilizer application (1.34%). Conversely, the K uptake in the soybean leaf upon Santap NM2 treatment (0.8%) was lower than non-treated plant (1.00%).

Physical and chemical property of the Alfisols of Probolinggo as described in Table 2 and 3 can support the growth of Sinabung-1036 soybean. Application of organic and inorganic fertilizers does not affect the number of the harvested crop, yield components, and soybean seed yield. At harvest time, the plant population was 287,000

plants/ha, with a seed yield of 2.66 t/ha. The 100 seeds weight was 15.53 g, and the seed weight per plant was 19.20 g (Table 8). In conclusion, the application of organic and inorganic fertilizers on the Lokal Jateng/Sinabung-1036 soybeans grown on the Alfisols of Probolinggo is not essential to achieve the potential yield of the soybeans.

### Vertisols experiments

Planting activities on the Vertisols of Ngawi conducted at the beginning of June 2012. The former rice paddy land underwent no tillage. At the time of planting, there was still rain, so the soils were slippery due to its high clay fraction (78%). In this soil condition, the Lokal Jateng/Sinabung-1036 could grow optimally. The soybean canopy closure occurred at 34 DAP.

**Table 5.** Effects of organic and inorganic fertilizers on germination, root dry weight 40 DAP, shoot dry weight 40 DAP, and plant height at harvest of Lokal Jateng/Sinabung-1036 soybean line in Alfisols at Muneng Research Station, Probolinggo, East Java Province, Indonesia

Treatment	Germination (%)	Root dry weight 40 DAP (g/plant)	Shoot dry weight 40 DAP (g/plant)	Plant height at harvest (cm)
<b>Organic fertilizer</b>				
Without organic fertilizer	89.6 a	0.62 a	5.07 a	65.4 a
2.5 t/ha cow manure	90.4 a	0.68 a	5.63 a	64.9 a
5.0 t/ha cow manure	90.5 a	0.61 a	5.17 a	68.0 a
2.0 t/ha Santap NM2	89.9 a	0.63 a	5.02 a	64.5 a
<b>ZA + SP-36 + KCl (kg/ha)</b>				
0 + 0 + 0	91.8 a	0.64 a	5.17 a	66.3 a
50 + 50 + 100	89.1 a	0.66 a	5.74 a	64.4 a
50 + 150 + 50	90.3 a	0.63 a	5.14 a	64.6 a
50 + 150 + 100	89.2 a	0.62 a	4.84 a	67.4 a
Interaction	ns	ns	ns	ns
CV (%)	5.79	7.04	9.60	5.57

Note: Numbers followed by different letters in a column were significantly different according to LSD test ( $P < 0.05$ ); CV: coefficient of variation.

**Table 6.** Effects of organic and inorganic fertilizers on branch number, filled pod number, and soil penetration of Lokal Jateng/Sinabung-1036 soybean line in the Alfisols at Muneng Research Station, Probolinggo, East Java Province, Indonesia

Treatment	Branch no./plant	Filled pod no./plant	Soil penetration (kg/cm <sup>2</sup> )
<b>Organic fertilizer</b>			
Without organic fertilizer	2.2 b	45.4 a	1.85 a
2.5 t/ha cow manure	2.5 ab	46.0 a	1.55 a
5.0 t/ha cow manure	2.3 b	47.0 a	1.71 a
2.0 t/ha Santap NM2	2.6 a	47.0 a	1.94 a
<b>ZA + SP-36 + KCl (kg/ha)</b>			
0 + 0 + 0	2.4 a	46.2 a	1.71 a
50 + 50 + 100	2.5 a	46.9 a	1.76 a
50 + 150 + 50	2.3 a	46.6 a	1.84 a
50 + 150 + 100	2.3 a	45.7 a	1.76 a
Interaction	ns	ns	ns
CV (%)	15.02	5.21	8.49

Note: Numbers followed by different letters in a column were significantly different according to LSD test ( $P < 0.05$ ).

On the Vertisols of Ngawi, we found that the application of organic and inorganic fertilizers did not affect seed germination and plant height at harvest. The germination rate reaches 89%, with an average plant height of 51 cm at harvest (Table 9). However, the application of 2.5 t/ha cow manure improve growth and shoot dry weight to 4.78 g/plant which is 0.92 g/plant (24%) higher than without organic fertilizer application. In the previous study, application of 15 t/ha cow manure resulted in a higher soybean plant growth and increased nutrient uptake by the soybean plant than without fertilizer (Sudarsono et al. 2013).

At the time of analysis of plant tissue age 40 DAP with composite samples I, II, and III, it turns out the application of 2.5 t/ha cow manure led to the lowest N, P, and K content of the soybean compared to all organic fertilizers treatments. Application of 50 kg ZA + 150 kg SP-36 + 50 KCl/ha led the lowest N, P, and K content of Lokal Jateng/Sinabung-1036 soybean line compared to all inorganic fertilizers treatments (Table 10).

Application of organic and inorganic fertilizers did not affect the soil penetration resistance following harvesting. After harvesting, the top soil of the Vertisols was dry and hard with an average soil penetration resistance reaches 3.01 kg/cm<sup>2</sup> (Table 11). The soil penetration resistance of the top soil of the Alfisols following harvesting was only 1.77 kg/cm<sup>2</sup>. In addition, application of all the fertilizers did not affect the branch number, filled pod number, and 100 seed weight (Table 11 and 12).

Application of 50 kg ZA + 50 kg SP-36 + 100 kg KCl/ha significantly increases filled pod number/plant. Accordingly, the treatment results in a 17% increase in seed weight per plant compared with no inorganic fertilizer treatment. However, the same treatment does not lead to an increase in the seed yield of Lokal Jateng/Sinabung-1036 soybean. Meanwhile, application of organic fertilizer Santap NM2 on Lokal Jateng/Sinabung-1036 results an increase in the soybean seed yield (2.81 t/ha) compared with no treatment control (2.60 t/ha) (Table 12). According to Muzaiyanah et al. (2015), application of 1.5 t/ha Santap NM2 were able to substitute the use of inorganic fertilizer Phonska up to 50% (equal to 150 kg/ha Phonska).

**Table 7.** Effects of organic and inorganic fertilizers on N, P, and K content of Lokal Jateng/Sinabung-1036 soybean at 40 DAP in the Alfisols at Muneng Research Station, Probolinggo, East Java Province, Indonesia

Treatment	N (g/plant)	P (g/plant)	K (g/plant)
<b>Organic fertilizer</b>			
Without organic fertilizer	0.591	0.031	1.676
2.5 t/ha cow manure	0.557	0.028	1.038
5.0 t/ha cow manure	0.701	0.024	1.164
2.0 t/ha Santap NM2	0.786	0.024	1.012
<b>ZA + SP-36 + KCl (kg/ha)</b>			
0 + 0 + 0	0.636	0.029	1.447
50 + 50 + 100	0.645	0.023	0.979
50 + 150 + 50	0.697	0.027	0.881
50 + 150 + 100	0.657	0.028	1.583

Thus, from this study, we can conclude that, on the Alfisols of Probolinggo, Lokal Jateng/Sinabung-1036 soybean line did not require additional inorganic fertilizer to achieve 2.71 t/ha. On the Vertisols of Ngawi, however, the soybean need 2 t/ha Santap NM2 organic fertilizer to increase its yield to 2.81 t/ha.

**Table 8.** Effects of organic and inorganic fertilizers on plant population, seed yield, 100 seed weight, and seed weight of Lokal Jateng/Sinabung-1036 soybean line in the Alfisols at Muneng Research Station, Probolinggo, East Java Province, Indonesia

Treatment	Plant population (plant/ha)	Seed yield (t/ha)*	100 seed weight (g)	Seed weight (g/plant)
<b>Organic fertilizer</b>				
Without organic fertilizer	289159 a	2.66 a	15.78 a	18.55 a
2.5 t/ha cow manure	284240 a	2.73 a	15.57 a	19.49 a
5.0 t/ha cow manure	289159 a	2.66 a	15.28 a	19.49 a
2.0 t/ha Santap NM2	286555 a	2.58 a	15.48 a	19.27 a
<b>ZA + SP-36 + KCl (kg/ha)</b>				
0 + 0 + 0	292149 a	2.71 a	15.92 a	19.46 a
50 + 50 + 100	286362 a	2.62 a	15.62 a	19.41 a
50 + 150 + 50	288291 a	2.66 a	15.21 a	19.05 a
50 + 150 + 100	282311 a	2.64 a	15.36 a	18.88 a
Interaction	*	ns	ns	ns
CV (%)	5.83	7.28	4.94	8.82

Note: Numbers followed by different letters in a column were significantly different according to LSD test (P<0.05). (\*) at 12% humidity

**Table 9.** Effects of organic and inorganic fertilizers on germination, root dry weight 40 DAP, shoot dry weight 40 DAP, and plant height at harvest of Lokal Jateng/Sinabung-1036 soybean line in the Vertisols at Ngale Research Station, Ngawi, East Java Province, Indonesia

Treatment	Germination (%)	Shoot dry weight at 40 DAP (g/plant)	Plant height at harvest (cm)
<b>Organic fertilizer</b>			
Without organic fertilizer	87.1 a	3.86 b	50.6 a
2.5 t/ha cow manure	90.9 a	4.78 a	52.2 a
5.0 t/ha cow manure	90.5 a	3.86 b	51.0 a
2.0 t/ha Santap NM2	89.1 a	4.36 ab	51.2 a
<b>ZA + SP-36 + KCl (kg/ha)</b>			
0 + 0 + 0	92.5 a	3.95 a	49.0 a
50 + 50 + 100	89.2 a	4.42 a	51.9 a
50 + 150 + 50	88.7 a	4.64 a	52.0 a
50 + 150 + 100	87.1 a	3.86 a	52.0 a
Interaction	ns	ns	ns
CV (%)	6.39	10.99	8.52

Note: Numbers followed by different letters in a column were significantly different according to LSD test (P<0.05). ns: not significant.

**Table 10.** Effects of organic and inorganic fertilizers on N, P, and K content of Lokal Jateng/Sinabung-1036 soybean at 40 DAP in the Vertisols at Ngale Research Station, Ngawi, East Java Province, Indonesia

Treatment	N (g/plant)	P (g/plant)	K (g/plant)
<b>Organic fertilizer</b>			
Without organic fertilizer	0.840	0.076	0.664
2.5 t/ha cow manure	0.637	0.053	0.540
5.0 t/ha cow manure	0.855	0.077	0.613
2.0 t/ha Santap NM2	0.727	0.059	0.651
<b>ZA + SP-36 + KCl (kg/ha)</b>			
0 + 0 + 0	0.755	0.065	0.631
50 + 50 + 100	0.759	0.070	0.640
50 + 150 + 50	0.685	0.054	0.484
50 + 150 + 100	0.859	0.076	0.713

**Table 11.** Effects of organic and inorganic fertilizers on branch number, filled pod number, and soil penetration of Lokal Jateng/Sinabung-1036 soybean line in the Vertisols at Ngale Research Station, Ngawi, East Java Province, Indonesia

Treatment	Branch no./plant	Filled pod no./plant	Soil penetration (kg/cm <sup>2</sup> )
<b>Organic fertilizer</b>			
Without organic fertilizer	1.6 a	29.2 a	3.02 a
2.5 t/ha cow manure	1.9 a	30.7 a	3.21 a
5.0 t/ha cow manure	1.7 a	30.4 a	3.31 a
2.0 t/ha Santap NM2	2.0 a	31.9 a	2.52 a
<b>ZA + SP-36 + KCl (kg/ha)</b>			
0 + 0 + 0	1.6 a	29.4 b	3.16 a
50 + 50 + 100	2.0 a	32.8 a	3.03 a
50 + 150 + 50	1.6 a	30.9 ab	2.86 a
50 + 150 + 100	1.8 a	29.1 b	3.01 a
Interaction	ns	ns	ns
CV (%)	10.15	10.62	12.98

Note: Numbers followed by different letters in a column were significantly different according to LSD test ( $P < 0.05$ ).

**Table 12.** Effects of organic and inorganic fertilizers on plant population, seed yield, 100 seed weight, and seed weight of Lokal Jateng/Sinabung-1036 soybean line in the Vertisols at Ngale Research Station, Ngawi, East Java Province, Indonesia

Treatment	Plant population (plant/ha)	Seed yield (t/ha)*	100 seed weight (g)	Seed weight (g/plant)
<b>Organic fertilizer</b>				
Without organic fertilizer	301080 a	2.60 b	19.21 a	10.82 a
2.5 t/ha cow manure	298148 a	2.70 ab	18.84 a	11.54 a
5.0 t/ha cow manure	293596 a	2.60 b	19.32 a	11.37 a
2.0 t/ha Santap NM2	317670 a	2.81 a	19.08 a	12.07 a
<b>ZA + SP-36 + KCl (kg/ha)</b>				
0 + 0 + 0	297608 a	2.64 a	18.86 a	10.72 b
50 + 50 + 100	303704 a	2.69 a	19.25 a	12.53 a
50 + 150 + 50	314429 a	2.62 a	19.23 a	11.49 ab
50 + 150 + 100	294753 a	2.76 a	19.10 a	11.06 b
Interaction	ns	*	ns	ns
CV (%)	11.33	8.19	5.57	13.47

Note: Numbers followed by different letters in a column were significantly different according to LSD test ( $P < 0.05$ ). (\*) at 12% humidity.

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