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Effect of organic manure and potash fertilizer on yield and yield attributes of soybean (*Glycine max* (L.) Merrill

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Abstract
A field experiment entitled ''Effect of organic manure and potash fertilizer on growth of soybean (*Glycine max* (L.) Merrill)" was conducted on medium black clay soil of Instructional Farm, Junagadh Agricultural University, Junagadh (Gujarat) during kharif season of 2009. The experiment comprising nine treatment combinations of three levels of organic manure viz., no organic manure (M_0), FYM @ 5.0 t ha^{-1} (M_1) and vermicompost @ 0.25 t ha^{-1} (M_2) and three levels of potash fertilizer viz., no potash (K_0), potash @ 20 kg ha^{-1} (K_1) and potash @ 40 kg ha^{-1} (K_2) were tried in factorial randomized block design with four replications. The result showed that the application of FYM @ 5.0 t ha^{-1} (M_1) produced significantly highest Number of pods per plant (64.50), Number of seeds per pod (2.71), Seed yield per plant (12.90 g), Test weight (15.50 g), Seed yield (1700 kg ha^{-1}) and Stover yield (2000 kg ha^{-1}), which was 29.86, 9.72, 32.99,10.71,20.74 and 17.03 per cent higher over control (M_0), respectively and also application of vermicompost @ 0.25 t ha^{-1} (M_2) found statistically equivalent to FYM in respect of Seed yield per plant, Test weight, Seed yield (kg ha^{-1}) and Stover yield (kg ha^{-1}) which increased Seed yield per plant, Test weight, Seed yield (kg ha^{-1}) and Stover yield (kg ha^{-1}) to the 24.74,5.71,12.93,and 10.53 per cent over control (M_0), respectively. Different potash levels significant influence on yield attributes and yield. Similarly aapplication of potash @ 40 kg ha^{-1} (K_2) recorded significantly highest Number of pods per plant (62), Number of seeds per pod (2.66), Seed yield per plant (g) (12.23), Test weight (g)(15.25), Seed yield (kg ha^{-1}) (1670) and Stover yield (kg ha^{-1}) (1971), which were 21.98, 5.98,20.26,6.94,14.38 and 12.05 per cent higher over control (K_0), respectively.

Keywords: soybean, yield, organic manure, vermicompost, potash

Introduction
Soybean [*Glycine max* (L.) Merrill] is considered a miracle crop because of its dual qualities, *viz.,* high protein content and oil in seed. These two parameters in one crop have thus gained considerable importance in the agricultural economy of the World. Soybean is cultivated extensively in south Asia and USA. In India, soybean cultivation was introduced in 1977. It has high yield potential, wide adaptability, short duration and very high nutritional value having a vast multiplicity of uses as food and industrial products. Other than the whole phase, a lot of processed soya milk, soya flour, soya urid, tofu (Soya paneer) and some fermented soya are its products. Being a legume, it fixes a large amount of atmospheric nitrogen in soil. Therefore, soybean crop is known as "Golden Bean", "Miracle Crop", "Wonder Crop" and "Gold of Soil".

At present the dramatic increase in soya food sell is largely due to low cholesterol content, which is beneficial for heart and safe health. From nutritional point of view, soybean contains 43.2 per cent protein and 20.0 per cent edible oil. The protein content of soybean seeds is approximately 12 times more than that of milk, four times than that of eggs and two times than that of meat. Soybean protein is also rich in valuable amino acid "lysine" (5%) which is deficient in most of the cereals. In addition, it contains good amount of minerals, salts and vitamins (thiamine and riboflavin) and its sprouting seeds contain considerable amount of vitamin C (Singh, 1996) [6]. Soybean contains lesser amount of starch, thus it is good for diabetic patients.

Materials and Methods
The field experiment was conducted in plot no.D-6 at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during the Kharif season 2009. Junagadh is situated in South Saurashtra Agro-Climatic Zone of the Gujarat state. Geographically, this place is located at 21.50 N latitude and 70.50 E longitude with an altitude of 60 meters above the mean sea level on the western side at the foothills of Mount Girnar.

This place experiences the typical sub-tropical climate characterized by fairly cold and dry winter, hot and dry summer and moderately humid season.

Distance between replications was kept 2 m wide. Plot size for each treatment was 5.0 m x 3.6 m and with spacing 45 x 10 cm. The experiment was laid out in factorial randomized block design (FRBD) with four replications. The treatments of organic manures were, control (M_0), FYM @ 5.0 t ha^{-1} (M_1), vermicompost @ 0.25 t ha^{-1} (M_2), with three different potash levels i.e. K_0= Control K_1=20 kg ha^{-1} and K2=40 kg ha^{-1} as main treatment. Nine treatment combination were used are M0K0 (M_0=00.00 Level of organic manure (t ha^{-1}) & K0=00.00 Level of potash (Kg ha^{-1}), M0K1 (M0=00.00 Level of organic manure (t ha^{-1}) & K0=20.00Level of potash (Kg ha^{-1}), M0K2 (M0=00.00 Level of organic manure (t ha^{-1}) & K0=40.00Level of potash (Kg ha^{-1}), M1K0 (M0=05.00 Level of organic manure (t ha^{-1}) & K0=00.00Level of potash (Kg ha^{-1}), M1K1 (M0=05.00 Level of organic manure (t ha-^{1}) & K0=20.00Level of potash (Kg ha^{-1}), M1K2 (M0=05.00 Level of organic manure (t ha^{-1}) & K0=40.00Level of potash (Kg ha^{-1}), M2K0 (M0=00.25 Level of organic manure (t ha^{-1}) & K0=00.00Level of potash(Kg ha$^{-1)}$, M2K1 (M0=00.25 Level of organic manure (t ha^{-1}) & K0=20.00Level of potash (Kg ha^{-1}), M2K2 (M0=00.25 Level of organic manure (t ha^{-1}) & K0=40.00Level of potash (Kg ha^{-1}).

Soybean (GS-1) was sown in rows with 45 x 10 cm spacing using a seed rate 60 kg ha^{-1}. The fertilizer to the soybean was applied as per treatments. While Organic manures like FYM, Vermicompost and Potash were applied before sowing in furrows as per treatment. Data on the relevant aspect were collected for all treatment at different stages during growth period. All the observations were recorded at around 12.00 noon on the day of observation.

Result and Discussion

Yield attributes and yield

The result showed that the application of FYM @ 5.0 t ha^{-1} (M1) produced significantly highest Number of pods per plant (64.50), Number of seeds per pod (2.71), Seed yield per plant (12.90 g), Test weight (15.50 g), Seed yield (1700 kg ha^{-1}) and Stover yield (2000 kg ha-1), which was 29.86, 9.72, 32.99,10.71,20.74 and 17.03 per cent higher over control (M0), respectively and also application of vermicompost @ 0.25 t ha-1 (M2) found statistically equivalent to FYM in respect of Seed yield per plant, Test weight, Seed yield (kg ha^{-1}) and Stover yield (kg ha-1) which increased Seed yield per plant, Test weight, Seed yield (kg ha-1) and Stover yield (kg ha^{-1}) to the 24.74,5.71,12.93,and 10.53 per cent over control (M0), respectively. Different potash levels significant influence on yield attributes and yield. Similarly application of potash @ 40 kg ha-1 (K2) recorded significantly highest Number of pods per plant (62), Number of seeds per pod (2.66), Seed yield per plant (g) (12.23), Test weight (g)(15.25), Seed yield (kg ha-1) (1670) and Stover yield (kg ha-1) (1971), which were 21.98, 5.98,20.26,6.94,14.38 and 12.05 per cent higher over control (K0), respectively.

Application of FYM @ 5.0 t ha^{-1} (M1) produced significantly highest Number of pods per plant (64.50), Number of seeds per pod (2.71), Seed yield per plant (g) (12.90), Test weight (g) (15.50), Seed yield (kg ha^{-1}) (1700) and Stover yield (kg ha^{-1}) (2000), which was 13.38, 18.05 and 20.34 per cent higher over control (M0), respectively. application of vermicompost @ 0.25 t ha-1 (M2) found statistically equivalent to FYM in respect of Seed yield per plant, Test weight, Seed yield (kg ha-1) and Stover yield (kg ha^{-1}) which increased Seed yield per plant, Test weight, Seed yield (kg ha^{-1}) and Stover yield (kg ha-1) to the 24.74,5.71,12.93,and 10.53 per cent over control (M0), respectively. Different potash levels significant influence on yield attributes and yield. Similarly application of potash @ 40 kg ha-1 (K2) recorded significantly highest Number of pods per plant (62), Number of seeds per pod (2.66), Seed yield per plant (g) (12.23), Test weight (g) (15.25), Seed yield (kg ha-1) (1670) and Stover yield (kg ha^{-1}) (1971),which were 21.98, 5.98,20.26,6.94,14.38 and 12.05 per cent higher over control (K0), respectively.

Table 1: Effect of organic manures and potash fertilization on number of pods per plant and number of seeds per pod of soybean

Treatments	Number of pods per plant	Number of seeds per pod
Organic manures		
M_0 - Control	49.67	2.47
M_1 - FYM @ 5 ha^{-1}	64.50	2.71
M_2 - Vermicompost @ 0.25 ha^{-1}	56.50	2.58
S.Em. ±	1.36	0.03
C.D.at5%	3.99	0.11
Potash levels		
K_0 - Control	50.83	2.51
K_1 - 20 kg K_2O ha^{-1}	57.83	2.59
K_2 - 40 kg K_2O ha^{-1}	62.00	2.66
S.Em.±	1.36	0.03
C.D.at 5 %	3.99	0.11
Interaction		
S.Em.±	2.37	0.06
C.D.at5%	NS	NS
C.V.%	8.34	5.15

Table 2: Effect of organic manures and potash fertilization on seed per plant yield and test weight of soybean

Treatments	Seed yield per plant (g)	Test weight (g)
Organic manures		
M_0 – Control	9.70	14.00
M_1 - FYM @ 5 ha^{-1}	12.90	15.50
M_2 - Vermicompost @ 0.25 ha^{-1}	12.10	14.80
S.Em.±	0.28	0.26
C.D.at5%	0.82	0.76
Potash levels		
K_0 – Control	10.17	14.26
K_1 – 20 kg ha^{-1}	11.57	14.76
K_2 - 40 kg ha^{-1}	12.23	15.25
S.Em.±	0.28	0.26
C.D.at5%	0.82	0.76
Interaction		
S.Em.±	0.48	4.50
C.D.at5%	NS	NS
C.V.%	1.42	6.10

Table 3: Effect of organic manures and potash fertilization on seed yield and stover yield of soybean

Treatments	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})
Organic manures		
M_0 - Control	1408	1709
M_1 - FYM @ 5 t ha^{-1}	1700	2000
M_2 - Vermicompost @ 0.25 t ha^{-1}	1590	1889
S.Em.±	41.02	41.42
C.D. at 5%	119.75	120.91
Potash levels		
K_0 - Control	1460	1759
K_1 - 20 kg K_2O ha^{-1}	1568	1867
K_2 - 40 kg K_2O ha^{-1}	1670	1971
S.Em. ±	41.02	41.42
C.D. at 5%	119.75	120.91
Interaction		
S.Em.±	71.06	71.74
C.D. at 5%	NS	NS
C.V. %	9.07	7.69

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