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EFFECT OF PHOSPHORUS RICH COMPOST ON GROWTH PARAMETERS AND PRODUCTIVITY OF BLACKGRAM (*VIGNA MUNGO*)

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KEYWORDS

Phosphorus rich compost
Recommend dose of phosphorus
DAP
SSP
PSB Vermiculture

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ABSTRACT

A field experiment was carried out at the instructional Farm, Rajasthan College of Agriculture, Udaipur during *Kharif* 2013 to study the use of phosphorus rich compost in blackgram (*Vigna mungo*). Application of various sources of phosphorus (DAP, SSP and PRC incubate with and without PSB and Vermiculture) significantly increase growth parameters and yield of blackgram was recorded under treatment 25% RDP through PRC + Vermiculture + PSB + 75% RDP through DAP. The plant height, dry matter, Seed, Haulm and biological yield of Blackgram significantly increased by 36.91, 33.69, 107.58, 82.56 and 91.97 per cent, respectively over control. However, it was found statistically at par with other phosphorus sources (DAP, SSP and PRC).

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INTRODUCTION

Among the 17 essential plant nutrients, phosphorus is the second most limiting nutrient after nitrogen in majority of soils for crop production. It plays a key role in plant metabolism and essential for all living creatures for their growth and development. Being involved in various biochemical processes, it ensures transfer and storage of energy as ADP and ATP (Kokani *et al.*). In India, the economy being predominantly based on agriculture, the fertilizer production plays a pivotal role.

The cost of conventional fertilizer like DAP, SSP is so high and restrict their use by sizable poor farming community. Only about 35% to 40% of the requirements of raw material for phosphatic fertilizer production are being met through indigenous sources and the rest is met through import in the form of rock phosphate, phosphoric acid and direct fertilizers (Tisdale *et al.*, 1995). This has given impetus to find out cheaper and indigenous source of P fertilizer. The total rock phosphate deposits in India are estimated to be about 300 MT. (TIFAC 2011) of which only a fraction of it (about 25%) meets the specification of the fertilizer industry because of low P content (low grade).

Blackgram is an important pulse crop among the grain legumes grown in India. It is a rich protein food, contains about 26% protein, 1.2% fat and 56.6% carbohydrates on dry weight basis and it is rich source of calcium and iron (Amruta *et. al*). It is the richest in phosphoric acid among the pulses being five to ten times richer than others.

In India, black gram is grown on 3.07 million ha area in India with a production of 1.90 million metric ton (*Anonymous*, 2013). Black gram is a rainfed crop predominantly grown in *kharif* in the state of Rajasthan. In Rajasthan, blackgram occupy 2.18 lac ha area with a production of 1.25 lac ton. However, productivity of black gram is low in Rajasthan (575 kg ha^{-1}) (*Anonymous*, 2013). The productivity is quite lower than other developed countries mainly due to sub-optimal application of fertilizers and cultivation on marginal lands. The phosphorus rich compost being cheaper and eco-friendly and could be the alternatives of chemical fertilizers for improving both crop productivity and sustainability of the systems. Therefore, the present study was carried out with objective to study the effect of phosphorus rich compost on growth parameters and yield of blackgram in agro climatic zone IVA of Rajasthan.

MATERIALS AND METHODS

The experiment was conducted at the Instructional Farm, Rajasthan College of Agriculture, Udaipur during *Kharif* 2013. The site is situated at South-Eastern part of Rajasthan at an altitude of 579.5 m above mean sea level, at 24º35' N latitude and 74º42' E longitude. The mean annual rainfall of the region is 610.2 mm, most of which is contributed by south west monsoon from July to September. Maximum and minimum temperatures ranged between 27.1 to 32.6ºC and 14.2 to 24.8ºC, respectively during *Kharif* 2013. Before conducting the experiment, initial characteristics of the soil was determined by standards procedure as described by

Jackson (1973). The soil of the experimental field was sandy clay loamy in texture, slightly alkaline (pH 7.77), medium in organic carbon (0.58%), nitrogen (276.30 kg ha^{-1}), P_2O_5 (20.69 kg ha^{-1}) and high in K_2O (427.60 kg ha^{-1}). and sufficient amount of DTPA extractable micronutrients.

Four different type of phosphorus rich compost were prepared using farm wastes and cow dung with rock phosphate (RP), farm wastes and cow dung with RP + PSB, farm wastes and cow dung with RP + worms and farm wastes and cow dung with RP + PSB + worms to compare the efficiency of these different type of PRC on the yield and nutrient uptake by maize. For the preparation of the phosphorus rich compost (PRC), four pits of six feet length and two feet depth was made. The pits were filled with crop residue; FYM and Jhhamarkotra rock phosphate in the ratio of 10:1, respectively and mix them well. The mixed material was filled to all the four pits, and finally was add water for better composting. After twenty days of composting were release vermiculture in the two pits having treatment of worms and PSB. The organic material was composted and vermicomposted for three months and all pits was keep moist throughout the composting period.

The experiment was laid out in random block design having three replications with following 11 treatments T_1 (Control), T_2 (100% RDP through DAP), T_3 (100% RDP through SSP), T_4 (25% RDP through PRC + 75% RDP through DAP), T_5 (25% RDP through PRC + PSB + 75% PDP through DAP), T_6 (25% RDP through PRC + Vermiculture + 75% PDP through DAP), T_7 (25% RDP through PRC + Vermiculture + PSB + 75% RDP through DAP), T_8 (100% RDP through PRC), T_9 (100% RDP through PRC + PSB), T_{10} (100% RDP through PRC + Vermiculture) and T_{10} (100% RDP through PRC + Vermiculture + PSB). The field was prepared by cross cultivator followed by planking to obtain well pulverized soil tilth. During sowing full dose of N, P_2O_5 and K_2O were applied as basal dose.

The observations on growth parameters and yield of blackgram were recorded at harvest. The data collected was analyzed statistically by using Fisher's analysis of variance technique and individual treatment means were separated by using least significant difference (RBD) test at 5 percent probability level.

RESULTS AND DISCUSSION

Growth Parameters and Yield

The perusal of data in Table 1 and 2 revealed that application of phosphorus sources had significant increase in growth parameters and yield of blackgram over control. The perusal of data (Table 4.1) shows that plant height of black gram was not significantly affected among the different sources of phosphorus. The highest plant height (70.10 cm) was recorded under treatment 25% RDP through PRC + Vermiculture + PSB + 75% RDP through DAP (T_7) which was at par with rest of all the treatments and proved significantly

Table 1: Effect of phosphorus rich compost on growth parameters of blackgram

	Treatments	Plant height (cm)	Dry matter (g $plant^{-1}$)
T_1	Control	54.48	16.25
T_2	100% RDP through DAP	68.48	25.05
T_3	100% RDP through SSP	66.74	24.25
T_4	25% RDP through PRC + 75% RDP through DAP	65.30	21.59
T_5	25% RDP through PRC + PSB + 75% RDP through DAP	66.95	24.20
T_6	25% RDP through PRC + Vermiculture + 75% RDP through DAP	66.80	23.73
T_7	25% RDP through PRC + Vermiculture + PSB + 75% RDP through DAP	70.10	26.92
T_8	100% RDP through PRC	64.10	20.75
T_9	100% RDP through PRC + PSB	64.60	23.44
T_{10}	100% RDP through PRC + Vermiculture	65.19	22.05
T_{11}	100% RDP through PRC + Vermiculture + PSB	68.17	26.21
	SEm ±	2.46	1.34
	CD (5%)	7.25	3.96

Table 2: Effect of phosphorus rich compost on yield of blackgram

	Treatments	Seed Yield (kg ha^{-1})	HaulmYield (kg ha^{-1})	Biological Yield(kg ha^{-1})	Net Return (₹ ha^{-1})	B:C Ratio
T_1	Control	591.00	1134.72	1725.72	19836	1.41
T_2	100% RDP through DAP	1054.00	2023.68	3077.68	43428	2.64
T_3	100% RDP through SSP	1043.77	2004.03	3047.80	42679	2.61
T_4	25% RDP through PRC + 75 % RDP through DAP	875.90	1681.73	2557.63	35866	2.15
T_5	25% RDP through PRC + PSB + 75% RDP through DAP	1022.74	1963.67	2986.41	40851	2.47
T_6	25% RDP through PRC +Vermiculture + 75 % RDP through DAP	1001.33	1922.56	2923.89	38576	2.40
T_7	25% RDP through PRC + Vermiculture + PSB + 75 % RDP through DAP	1090.70	2094.14	3184.84	46573	2.85
T_8	100% RDP through PRC	863.83	1658.56	2522.39	33455	1.92
T_9	100% RDP through PRC + PSB	944.84	1814.10	2758.94	38565	2.32
T_{10}	100% RDP through PRC + Vermiculture	883.00	1695.36	2578.36	35651	2.11
T_{11}	100% RDP through PRC + Vermiculture + PSB	1033.33	1986.88	3020.21	41115	2.57
	SEm ±	57.71	110.73	168.43	2771	0.17
	CD (5%)	170.23	326.64	496.87	8173	0.49

superior over T_1 (Control) by 28.67 per cent. And dry matter (26.92 g plant^{-1}), seed yield (1090.70 kg ha^{-1}), haulm yield (2094.14 kg ha^{-1}), biological yield (3184.84 kg ha^{-1}), net return (46573 ₹ ha^{-1}) and B:C ratio (2.85) was recorded under T_7 (25% RDP through PRC + Vermiculture + PSB + 75% RDP through DAP) which was statistically at par with treatment T_2 (100% RDP through DAP), T_3 (100% RDP through SSP), T_5 (25% RDP through PRC + PSB + 75% PDP through DAP), T_6 (25% RDP through PRC + Vermiculture + 75% PDP through DAP), T_9 (100% RDP through PRC + PSB) and T_{11} (100% RDP through PRC + Vermiculture + PSB) and significantly increased over rest of treatment and control.

Application of chemical fertilizers with phosphorus rich compost (incubate with PSB and Vermiculture) increased the growth parameters and yield component over control. It was due to improved physico-chemical properties of soil and provides a better soil environment for the biological activity and improved microbial population of the experiment soil and also supplies micronutrient which beneficial to the crop growth and productivity. Increasing organic matter in soil to microbial decomposition leading to production of H_2CO_4 and other organic acid this might have reduce p^H and lead to increase availability of P and other nutrients to crop plants for proper growth and development. The greater seed and haulm yield at higher fertility was attributed to increased plant height and dry matter accumulation plant^{-1}. The results of the present investigation are in agreement with the findings by several researchers (Biswas *et al.*, 1967; Tisdale *et al.*, 1995; Majumdar *et al.*, 2007; Mahanta and Rai, 2008; Phiri *et al.*, 2010; Imran *et al.*, 2011; Ramesha *et al.*, 2011; Devi *et al.*, 2012; Reza *et al.*, 2012; Vyas *et al.*, 2012; Sepat and Rai, 2013; Abbasi *et al.*, 2013).

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