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Effect of Panchagavya on Growth and Yield of Organic Blackgram [*Vigna mungo* (L.) Hepper]

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A B S T R A C T

A field experiment was conducted at the instructional farm of Rajasthan College of Agriculture, Udaipur, Rajasthan during *kharif* season of 2015 to study the effect of panchagavya on growth and yield of organic blackgram. The result indicate that application of panchagavya 4% recorded significantly maximum dry matter (7.20 g plant^{-1}), leaf area index (1.92), number of pods (27.42 plant^{-1}), number of seeds (6.78 pod^{-1}), test weight (38.46 g) seed yield (801 kg ha^{-1}), straw yield (1735 kg ha^{-1}), biological yield (2536 kg ha^{-1}), gross return (₹ 89642 ha^{-1}), net return (₹ 67042 ha^{-1}) and B:C ratio (2.96), respectively over rest of the treatments. Results further reveal that plant height (32.25 cm), dry matter (6.92g plant^{-1}), leaf area index (1.76), number of pods (25.23 plant^{-1}), number of seeds (6.12 pod^{-1}), seed yield (751 kg ha^{-1}), straw yield (1617 kg ha^{-1}), biological yield (2368 kg ha^{-1}), gross return (₹ 84021 ha^{-1}), net return (₹ 60977 ha^{-1}) and B:C ratio (2.64), blackgram was observed significantly highest with the application of panchagavya at both branching + flowering stages as compared to either application at branching or flowering branching and flowering stage.

Introduction

Blackgram is one of the most important pulse crop of India and it contributes 10% to the total pulse production in the country. It is mainly grown in Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Maharashtra and Rajasthan. Total area of blackgram in India is 3.26 million hectares with an annual production of 1.76 million tonnes and productivity 555 kg ha^{-1} during year 2015 (IIPR, 2015). The food values of blackgram lie in its high and easily digestible protein. Its seed contains approximately 25-28% protein, 1.0 - 1.5% oil, 3.5 - 4.5% fiber, 4.5 -5.5% ash and 62 - 65% carbohydrates on dry weight basis. It is also reported to be rich in vitamins A, B and B_3 (Sharma *et al.*, 2011). Imbalanced use of chemicals and second generation problems of green revolution in agriculture has weakened the ecological base in addition to degradation of soil, water resources and quality of the food. An awareness has sprung on the adoption of organic farming as an alternate to modern chemical agriculture (Kannaiyan, 2000).

Pulses are important components of organic farming systems in the country. In recent years, the use of fermented cow dung, cow urine, cow ghee, cow curd and cow milk with the name of panchagavya is getting adaptive popularity in Indian agriculture largely through the efforts of small groups of farmers. Panchagavya has got reference in the scripts of Vedas (divine scripts of Indian wisdom) and Vrikshayurveda (Natarajan, 2002). Panchagavya, an organic product has potential to play the role in promoting growth and providing immunity in plant system. The use of panchagavya results in higher growth, yield, and quality of crops (Choudhary *et al.*, 2014).

Materials and Methods

A field experiments was conducted during *kharif*, 2015 at Instructional Farm, Rajasthan College of Agriculture, situated in agro-climatic zone IV a (Sub-humid southern plain and Aravali Hills) of Rajasthan. The region has a semi-arid climate.

The soil of the experimental site was clay loam in texture with pH 7.6 and 0.58 per cent organic carbon. The experiment of was laid out in factorial randomized block design with three replications and assigning 21 treatment combinations consisting of control, comprising six doses of panchagavya (panchagavya 2%, panchagavya 4%, panchagavya 6%, panchagavya 8%, panchagavya 10% and indigenous panchagavya 2%) as growth promoter and three stages of application of panchagavya (branching, flowering and branching + flowering).

The blackgram variety PU-31 was sown on 9th July 2015 at 30 cm row to row spacing by using recommended seed rate of 16 kg ha^{-1}. All other agronomic practices were adopted as per need of the crop.

Results and Discussion

Effect on growth attributes

At harvest, application of panchagavya 4% gave the maximum plant height (35.89 cm) and recorded a significant increase of 32.93, 20.36, 8.66, 14.88, 16.26 and 8.96 per cent in plant height of blackgram over the control, 2%, 6%, 8% and 10% panchagavya and indigenous panchagavya 2%, respectively. Effect of indigenous panchagavya 2% on plant height of blackgram at harvest was significant over control but it was found at par with 2% panchagavya (Table 1). Application of panchagavya 4% gave significantly higher dry matter accumulation (7.20 g plant$^{-1)}$ of blackgram and recorded an increase in dry matter accumulation of blackgram at harvest to the tune of 14.47, 10.43, 6.67, 8.27, 9.76 and 10.60 per cent over the control, 2%, 6%, 8% and 10% panchagavya and indigenous panchagavya 2%, respectively. Data presented in Table 1 show that application of panchagavya 4% increase maximum leaf area index (1.76) of blackgram and recorded significantly increased 29.93, 23.08, 17.89, 20.00, 21.52 and 24.68 per cent at 45 DAS increase of leaf area index of blackgram was observed over control, 2%, 6%, 8% and 10% panchagavya and indigenous panchagavya 2%, respectively. Results further reveal that growth attributes of blackgram *viz*., plant height (35.89 cm), dry matter plant^{-1} (7.20 g plant^{-1}) and leaf area index (1.92) were observed significantly heighest with the application of panchagavya at branching + flowering stages as compared to branching alone and flowering. However, application of panchagavya at branching alone and flowering alone was found to be at par with each other in all cases.

Scorching was observed in the leaves at higher concentrations (6%, 8% and 10% panchagavya) which might have resulted in

decreased rate of photosynthetic activity which ultimately resulted in reduction in growth of blackgram at higher concentration of panchagavya. Similar findings were also observed in blackgram by Somasudaram *et al.,* 2003, in *Coleus forskohili* by Kanimozhi, 2004 and in *Abelmoschus esculents* by Rajesh and Kaliyamoorthy, 2013). Panchagavya contains N, P, K, S, Fe and Zn. Thus, balanced nutrition might have resulted in better development and robust growth. Panchagavya is also known to contain beneficial micro-organisms such as *Azospirillum*, *Azotobactor*, *Phosphobacteria* and *Pseudomonas* besides *Lactobacillus* (Yadav and Lourduraj, 2006) which promotes the plant growth parameters. Besides these, growth regulatory substances such as Indole acetic acid, gibberellic acid and cytokinin have also been reported in panchagavya (Perumal *et al.,* 2006) which resulted in improved plant height, LAI and dry matter accumulation of blackgram. The results of the present study are also in line with Emily (2003) who reported that in *Withania somnifera* (L.) Duna, the plant height, dry matter production and leaf area index increased significantly due to spraying panchagavya 4 %.

The application of panchagavya either at branching or flowering may not supply nutrients in sufficient amount for full development of the plants. Hence, higher plant height, dry matter plant^{-1} and leaf area index were observed with the application of panchagavya at branching + flowering stages of blackgram. Similar findings were also reported by Kumawat *et al.,* (2009).

Effect on yield attributes and yield

The data presented in Table 2 show that application of panchagavya 4% gave higher seed yield (801 kg ha^{-1}), straw yield (1735 kg ha^{-1}), biological yield (2536 kg ha^{-1}) of blackgram over the control, 2%, 6%, 8% and 10% panchagavya and indigenous panchagavya 2%. Further, the data (Table 2) indicate that application of panchagavya at branching + flowering stages recorded the highest seed yield (751 kg ha^{-1}), straw yield (1617 kg ha^{-1}), biological yield (2368 kg ha^{-1}) of blackgram over the application of panchagavya at branching and flowering. The easy transfer of nutrients and growth stimulants to plants through foliar spray of optimum dose of panchagavya might be the reason for enhancement in yield attributes. There are several reasons for increased yield in blackgram due to spray of panchagavya. Smaller quantities of IAA and GA present in panchagavya when foliar sprayed could have created stimuli in the plant system which in turn increased the production of growth regulator in cell system and the action of growth regulators in plant system stimulated the necessary growth and development, leading to better yield. This might be due to favorable effect of panchagavya on vegetative growth viz., number of branches plant^{-1} and reproductive growth viz., pods plant^{-1}, seeds pod^{-1} and test weight, which were the important yield attributes having significant positive correlation with seed & straw yield.

These findings are in the line with those reported by Somasundaram *et al.,* (2003), Somasundaram *et al.,* (2007), Kumawat *et al.,* (2009) and Mudigoudra *et al.,* (2009). The pronounced increase in yield might be due to sustained availability of nutrients (N, P, K, S, Zn and Fe) at growth phases of blackgram and also due to enhanced carbohydrate synthesis and effective translocation of photosynthates to the developing sink. Panchagavya increased synthesis of growth promoting substances which is turn helped in increased growth and yield attributes and finally grain yield. Similarly findings have been reported by Swaminathan *et al.,* (2007) and Choudhary *et al.,* (2014).

Table.1 Effect of doses of panchagavya and its stage of application on growth and yield attributes of organic blackgram

Treatments	Plant height (cm)	Dry matter (g plant^{-1})	Leaf area index	Number of pods plant^{-1}	Number of seeds pod^{-1}	Test weight (g)
Doses of panchagavya						
Control	27.00	6.29	1.48	19.11	5.32	33.58
Panchagavya 2%	29.82	6.52	1.56	23.54	5.51	34.75
Panchagavya 4%	35.89	7.20	1.92	27.42	6.78	38.46
Panchagavya 6%	33.03	6.75	1.63	24.99	6.11	35.97
Panchagavya 8%	31.24	6.65	1.60	24.66	5.80	35.86
Panchagavya 10%	30.87	6.56	1.58	23.99	5.73	35.41
Indigenous panchagavya 2%	29.58	6.51	1.54	23.33	5.47	34.88
SEm±	0.50	0.14	0.07	0.50	0.18	0.74
C.D.5%	1.44	0.39	0.20	1.42	0.52	2.11
Stage of panchagavya application						
Branching	30.56	6.55	1.57	22.86	5.64	34.63
Flowering	30.38	6.45	1.52	23.50	5.69	34.96
Branching + Flowering	32.25	6.92	1.76	25.23	6.12	37.09
SEm±	0.33	0.09	0.05	0.33	0.12	0.48
C.D.5%	0.94	0.26	0.13	0.93	0.34	1.38

Table.2 Effect of doses of panchagavya and its stage of application on yield and economics of organic blackgram

Treatments	Yield (kg ha^{-1})			Harvest index (%)	Gross return (₹ ha^{-1})	Net return (₹ ha^{-1})	B:C ratio
	Seed	Straw	Biological				
Doses of panchagavya							
Control	519	1272	1791	29	58918	36918	1.68
Panchagavya 2%	686	1512	2198	31	76914	54614	2.45
Panchagavya 4%	801	1735	2536	32	89642	67042	2.96
Panchagavya 6%	715	1534	2249	32	79926	57026	2.49
Panchagavya 8%	697	1519	2217	32	78068	54868	2.36
Panchagavya 10%	690	1505	2195	32	77322	53822	2.29
Indigenouspanchagavya 2%	681	1512	2193	31	76448	54073	2.42
SEm±	20	59	68	1	2121	2121	0.09
C.D.5%	57	168	193	NS	6063	6063	0.27
Stage of panchagavya application							
Branching	635	1470	2105	30	71581	49116	2.19
Flowering	667	1451	2118	31	74643	52063	2.30
Branching + Flowering	751	1617	2368	32	84021	60977	2.64
SEm±	13	38	44	1	1389	1389	0.06
C.D.5%	37	110	127	NS	3969	3969	0.18

Economics of the treatments

The data presented in Table 2 show that application of panchagavya 4% increased the gross return (₹89642 ha^{-1}), net return (₹67042 ha^{-1}) and B:C (2.96) ratio of blackgram as compared to control and other doses of panchagavya. Results further reveal that maximum gross return (₹84021 ha^{-1}), net return (₹60,977 ha^{-1}) and B:C (2.64) ratio blackgram was observed with the application of panchagavya at both branching + flowering stages as compared to either application at branching or flowering branching and flowering stage. The increased net return could be explained on the basis of increased seed (801 kg ha^{-1}) and straw yield (1735 kg ha^{-1}) under the panchagavya 4% in the present investigation.

Further, the benefit cost ratio was decreased due to application of lower and higher doses of panchagavya because effectiveness of panchagavya at 2%, 6%, 8% and 10% panchagavya and indigenous panchagavya 2% was less enhancing yield attributes and yield as compared to panchagavya 4%.

Similar finding were also observed in blackgram by Somasudaram *et al.,* 2003 and in *Abelmoschus esculents* by Rajesh and Kaliyamoorthy, 2013. The higher net return due to application of panchagavya at branching + flowering stage could be explained on the basis of increased seed and straw yield under the application of panchagavya at both branching + flowering stages in the present investigation. Similar findings were also observed in groundnut (Choudhary *et al.,* 2014). Similarly, Kumawat *et al.,* (2009) also reported that application of panchagavya at both branching + flowering stages resulted in significantly higher net return (₹55,376 ha^{-1}) as well as B: C ratio (2.66) over application of panchagavya either at branching or flowering.

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