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Effect of Different Nitrogen Levels and Varietal Performance on Growth and Yield of Summer Pearlmillet

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A B S T R A C T

A field experiment was conducted during Zaid season, 2015 at the Crop Research Farm, Department of Agronomy, SHIATS, and Allahabad (U.P.) to conclude the response of summer pearlmillet (*Pennisetum glaucum* L.) hybrids to levels of nitrogen. Among the response of different hybrids to levels of nitrogen, treatment T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK, recorded maximum plant height (175.30cm), number of tillers $plant^{-1}$ (3.67), dry weight (47.73g), crop growth rate (1.53 g m^{-2} day^{-1}), relative growth rate (0.052 g g^{-1} day^{-1}), number of ear $plant^{-1}$ 2.37, length of ear (27.52cm), number of Grains ear^{-1} (2406.49), test weight (10.29g), grain yield (3.72 t ha^{-1}), straw yield (6.98 t ha^{-1}), protein content (13.43%) and harvest index (36.15%). Whereas the lowest value in terms of plant height (164.47cm), number of tillers (2.60 $plant^{-1}$), dry weight (40.80g), crop growth rate (1.30 g m^{-2} day^{-1}), relative growth rate (0.045 g g^{-1} day^{-1}), number of ear (1.37 $plant^{-1}$), grain yield (2.47 t ha^{-1}) and straw yield (4.62 t ha^{-1}) was observed in the treatment T1 *i.e.*, V1 + 80:45:45 kg ha^{-1} NPK). Further, ear length of (21.16cm) was observed in the treatment T8 *i.e.*, V3 + 90:45:45 kg ha^{-1} NPK). In terms of number of grains (2406.49 ear^{-1}), test weight (8.04 g) was recorded in the treatment T5 *i.e.*, V2 + 90:45:45 kg ha^{-1} NPK). Further, protein content (9.48%) was observed in the treatment T5 *i.e.*, V2 + 90:45:45 kg ha^{-1} NPK) and harvest index (19.01%) respectively in the treatment T4 *i.e.*, V 2+ 80:45:45 kg ha^{-1} NPK.

Introduction

Pearlmillet [*Pennisetum glaucum* (L.)] is largely grown for grain and fodder purpose under those situations where other crops generally fail. Pearlmillet as a food crop is limited to the developing countries in Asia, and particularly in Africa and ranked sixth in the world following rice, wheat, corn, barley and sorghum (Anonymous, 2010-11). The important pearlmillet growing countries are India, China, Nigeria, Pakistan, Sudan, Egypt, Arabia, and Russia. It is estimated that over 95% of pearlmillet production is used as food, the reminder being divided between animal and poultry feed (7%), other uses (seed, bakery products, snacks, etc.) and waste. Pearlmillet is used in flat breads (roti) or mixed up to 25% with wheat flour for use in yeast breads. The genus *Pennisetum* is distributed throughout the tropics and subtropics of the world. It includes about 140 species, one African species *P. glaucum* (L.) R. Br. Emend Stuntz was domesticated as the cereal pearlmillet, and another African species, *P. Purpureum* schumach became widely distributed as a tropical forage grass. Pearlmillet is the most drought tolerant in all

domesticated cereals, and soon after its domestication it became widely distributed across the semi-arid tropics of Africa and Asia.

Pearlmillet is grown where no other cereal will yield grain, in regions with 200-800 mm of annual rainfall. In India, pearlmillet is popularly known as Bajra, and it is the fourth most important cereal crop after rice, wheat and sorghum. It has the greatest potential among all the millets. Annual planting area of the country under pearlmillet is 9.5 million hectares producing nearly 10.1 million tonnes of grains with productivity of 10.44 q ha^{-1} (Economic Survey of India, 2011).

The major producing states are Rajasthan (46%), Maharashtra (19%), Gujarat (11%), Uttar Pradesh (8%) and Haryana (6%), (Sonawane *et al.,* 2010). The nutrient content of pearlmillet compares very well with other cereals and millets. It has high protein content with slightly superior amino acid profile. Pearlmillet grain contains 13-14 per cent protein, 5-6 per cent fat, 74 per cent carbohydrate and 1-2 per cent minerals. It also contains higher amount of carotene, riboflavin (Vitamin B2) and niacin Vitamin B4 (Singh *et al.,* 2009).

Materials and Methods

Field experiment was conducted during Zaid season 2015 at Crop Research Farm, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed-to-be-University) Allahabad.

The soil of the experimental area was sandy loam with moderately alkaline pH; low in organic carbon (0.32%) and available N (188.30 kg ha^{-1}), available P (34.50 kg ha^{-1}) and available K (87.00 kg ha^{-1}) during zaid 2015 respectively. A recommended pearlmillet variety (Pro Agro 9444, Ganga kaveri 1044 and Pioneer 86 M 32) was chosen for the study.

The experiment was laid out in Randomized Block Design (RBD) with two factor different levels of Nitrogen and three improved Varieties with nine treatments combination on a plot size of 3 x 3 m^2. Before sowing, line were formed in the field as the spacing in treatments. Pearlmillet was sown in line and covered with the soil. Pearlmillet seeds were hand dibbled. The total quantity of nitrogen, phosphorus and potassium as per treatment in the form of Urea (46%), single super phosphate (16%) and MOP (60%) respectively were applied below the seeds at the time of sowing.

Two split application are applied, one at basal and the second application at top dressing. All the agronomic practices were carried out uniformly to raised the crop. For taking data on yield and yield components on pearlmillet five plants were selected randomly in each plot.

Results and Discussion

Plant height (cm)

The observations for plant height are being presented in the table 1. A perusal of this table reveals that there was a steady increase in the plant height between the day's intervals. The significant influences were observed in plant height due to different treatments.

There was significant difference between the treatments and maximum plant height (175.30 cm) was observed by the application of T9 *i.e.,* V3 + 100:45:45 kg ha^{-1} NPK, whereas the lowest value 164.47 cm was observed in treatment T1 *i.e.,* V1 + 80:45:45 kg ha^{-1} NPK. Further, treatments, T3 *i.e.,* V1 + 100:45:45kg ha^{-1} NPK, T6 *i.e.,* V2 + 100:45:45kg ha^{-1}

NPK, T7 *i.e.*, V 3+ 80:45:45 kg ha^{-1}, T8 *i.e.*, V3 + 90:45:45 kg ha^{-1} NPK, T2 *i.e.*, V1 + 90:45:45 kg ha^{-1} NPK and T4 *i.e.*, V2+ 80:45:45 kg ha^{-1} NPK were found statistically at par with T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK.

The probable reasons for recording higher stature of growth attributes viz., plant height, leaf area index, dry matter production and number of tillers m^{-2} was observed in different varieties due to increased levels of nitrogen with the application of 50 kg N ha^{-1}.

While all these parameters were at their lowest value with no nitrogen application in foxtail millet (*Setaria italica* L.) Naik *et al.*, (1995) and Basavarajappa *et al.*, (2002) were also observed similar finding in pearlmillet by AICRP Forage Crops (2006).

Tillers plant^{-1}

The observations for tillers plant^{-1} are being presented in the table 1. Perusal of this table reveals that there was a steady increase in the tillers plant^{-1} at all the day's intervals. The significant influences were observed in tillers plant^{-1} due to different treatments.

The maximum tillers plant^{-1} (3.67) was observed by the application of T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK, whereas the lowest value 2.60 was observed in treatment T1 *i.e.*, V1 + 80:45:45 kg ha^{-1} NPK (Table 2).

Further, treatments, T3 *i.e.*, V1 + 100:45:45kg ha^{-1} NPK was found statistically at par with T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK.

The probable reasons for recording higher stature of growth attributes viz., plant height, leaf area index, dry matter production and number of tillers m^{2} was observed in different varieties due to increased levels of nitrogen with the application of 50 kg N ha^{-1}.

While all these parameters were at their lowest value with no nitrogen application in foxtail millet (*Setaria italica* L.) Naik *et al.*, (1995) and Basavarajappa *et al.*, (2002) observed the similar finding in pearlmillet by AICRP Forage Crops (2006).

Experimental findings showed that the effect of nitrogen fertilization (30, 60 and 90 kg ha^{-1}) on growth and yield of pearlmillet and observed significant improvement in plant height, number of green leaves and number of tillers with 60 and 90 kg nitrogen over 30 kg ha^{-1}. The results are in conformity with those of Chaudhari *et al.*, (2002) Singh *et al.*, (1991), and Babu *et al.*, (1995).

Number of ear plant^{-1}

The result revealed that there was significant difference between the treatments and maximum ear plant^{-1} (2.37 plant^{-1}) was observed by the application of T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK whereas the lowest value 1.37 plant^{-1} was observed in treatment T1 *i.e.*, V1 + 80:45:45 kg ha^{-1} NPK. However, treatment, T3 *i.e.*, V1 + 100:45:45kg ha^{-1} NPK, T6 *i.e.*, V2 + 100:45:45kg ha^{-1} NPK was found statistically at par with T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK.

Length of ear (cm)

The result revealed that there was significant difference between the treatments and maximum length of ear (27.52cm) was obtained in T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK whereas the lowest value 21.16 cm was observed in treatment T8 *i.e.*, V3 + 90:45:45 kg ha^{-1} NPK.

Table.1 Response of hybrid and different levels of nitrogen on plant height of pearlmillet at different intervals

Treatment		Plant height (cm)			
		20 DAS	40 DAS	60 DAS	80 DAS
T_1	V_1 + 80:45:45 kg ha^{-1} NPK	34.80	101.67	161.70	164.47
T_2	V_1 + 90:45:45kg ha^{-1} NPK	34.98	102.80	165.47	171.20
T_3	V_1 + 100:45:45kg ha^{-1} NPK	39.47	109.10	168.40	173.60
T_4	V_2+ 80:45:45 kg ha^{-1} NPK	35.27	102.97	161.80	170.43
T_5	V_2 + 90:45:45 kg ha^{-1} NPK	35.37	106.30	166.43	167.67
T_6	V_2 + 100:45:45kg ha^{-1} NPK	38.50	108.40	167.23	172.53
T_7	V_3+ 80:45:45 kg ha^{-1} NPK	36.23	106.27	165.30	171.53
T_8	V_3 + 90:45:45 kg ha^{-1} NPK	36.40	103.37	168.40	171.23
T_9	V_3 + 100:45:45 kg ha^{-1} NPK	46.17	110.60	169.30	175.30
	F- test	NS	S	S	S
	S. Ed. (±)	5.343	2.697	2.285	2.781
	C. D. (P = 0.05)	-	5.718	4.844	5.895

Table.2 Response of hybrid and different levels of nitrogen on tillers $plant^{-1}$ of pearlmillet at different intervals

Treatment		Tillers $plant^{-1}$			
		20 DAS	40 DAS	60 DAS	80 DAS
T_1	V_1 + 80:45:45 kg ha^{-1} NPK	0.60	1.47	2.73	2.60
T_2	V_1 + 90:45:45kg ha^{-1} NPK	0.80	1.87	2.87	2.73
T_3	V_1 + 100:45:45kg ha^{-1} NPK	1.00	2.20	3.60	3.33
T_4	V_2+ 80:45:45 kg ha^{-1} NPK	0.67	1.87	2.73	2.60
T_5	V_2 + 90:45:45 kg ha^{-1} NPK	0.80	1.93	2.87	2.87
T_6	V_2 + 100:45:45kg ha^{-1} NPK	0.87	2.07	3.13	3.13
T_7	V_3+ 80:45:45 kg ha^{-1} NPK	0.67	1.67	2.87	2.87
T_8	V_3 + 90:45:45 kg ha^{-1} NPK	0.67	1.80	2.93	3.13
T_9	V_3 + 100:45:45 kg ha^{-1} NPK	1.13	2.60	3.78	3.67
	F- test	NS	S	S	S
	S. Ed. (±)	0.239	0.208	0.270	0.245
	C. D. (P = 0.05)	-	0.442	0.574	0.520

Table.3 Response of hybrid and different levels of nitrogen on Dry weight of pearlmillet at different intervals

Treatment			Dry weight (g plant^{-1})			
			20 DAS	40 DAS	60 DAS	80 DAS
T_1	V_1 + 80:45:45 kg ha^{-1} NPK	0.33	7.03	16.13	40.80	
T_2	V_1 + 90:45:45kg ha^{-1}NPK	0.37	7.78	16.54	45.37	
T_3	V_1 + 100:45:45kg ha^{-1} NPK	0.44	8.52	18.33	47.32	
T_4	V_2+ 80:45:45 kg ha^{-1}NPK	0.35	7.55	16.72	42.32	
T_5	V_2 + 90:45:45 kg ha^{-1} NPK	0.38	7.36	16.93	42.15	
T_6	V_2 + 100:45:45kg ha^{-1} NPK	0.39	8.22	17.62	46.27	
T_7	V_3+ 80:45:45 kg ha^{-1} NPK	0.37	7.53	16.76	42.01	
T_8	V_3 + 90:45:45 kg ha^{-1} NPK	0.34	7.25	16.69	42.57	
T_9	V_3 + 100:45:45 kg ha^{-1} NPK	0.45	9.03	18.50	47.73	
	F- test	NS	S	S	S	
	S. Ed. (±)	0.044	0.424	0.722	1.862	
	C. D. (P = 0.05)	-	0.900	1.532	3.948	

Table.4 Response of hybrid and different levels of nitrogen on Crop Growth Rate of pearlmillet at different intervals

Treatment			Crop Growth Rate (g m^{-2} day^{-1})			
			0-20 DAS	20-40 DAS	40-60 DAS	60-80 DAS
T_1	V_1 + 80:45:45 kg ha^{-1} NPK	0.016	0.34	0.44	1.30	
T_2	V_1 + 90:45:45kg ha^{-1}NPK	0.018	0.33	0.44	1.36	
T_3	V_1 + 100:45:45kg ha^{-1} NPK	0.021	0.40	0.51	1.42	
T_4	V_2+ 80:45:45 kg ha^{-1}NPK	0.017	0.37	0.43	1.37	
T_5	V_2 + 90:45:45 kg ha^{-1} NPK	0.018	0.36	0.46	1.38	
T_6	V_2 + 100:45:45kg ha^{-1} NPK	0.019	0.37	0.50	1.39	
T_7	V_3+ 80:45:45 kg ha^{-1} NPK	0.018	0.35	0.45	1.30	
T_8	V_3 + 90:45:45 kg ha^{-1} NPK	0.016	0.34	0.39	1.37	
T_9	V_3 + 100:45:45 kg ha^{-1} NPK	0.022	0.40	0.53	1.53	
	F- test	NS	S	NS	NS	
	S. Ed. (±)	0.002	0.021	0.06	0.114	
	C. D. (P = 0.05)	-	0.045	-	-	

Table.5 Response of hybrid and different levels of nitrogen on Relative Growth Rate of pearlmillet at different intervals

Treatment		Relative Growth Rate (g g^{-1} day^{-1})			
		0-20 DAS	20-40 DAS	40-60 DAS	60-80 DAS
T_1	V_1 + 80:45:45 kg ha^{-1} NPK	0.05	0.15	0.035	0.045
T_2	V_1 + 90:45:45kg ha^{-1} NPK	0.04	0.15	0.037	0.047
T_3	V_1 + 100:45:45kg ha^{-1} NPK	0.04	0.16	0.044	0.048
T_4	V_2 + 80:45:45 kg ha^{-1} NPK	0.05	0.15	0.035	0.047
T_5	V_2 + 90:45:45 kg ha^{-1} NPK	0.03	0.14	0.039	0.047
T_6	V_2 + 100:45:45kg ha^{-1} NPK	0.04	0.15	0.043	0.047
T_7	V_3 + 80:45:45 kg ha^{-1} NPK	0.03	0.15	0.039	0.046
T_8	V_3 + 90:45:45 kg ha^{-1} NPK	0.05	0.15	0.032	0.047
T_9	V_3 + 100:45:45 kg ha^{-1} NPK	0.05	0.16	0.045	0.052
	F- test	NS	S	NS	NS
	S. Ed. (±)	0.007	0.005	0.004	0.002
	C. D. (P = 0.05)	-	0.011	-	-

Table.6 Response of hybrid and different levels of nitrogen on protein content of pearlmillet

Treatment		Protein content (%)
T_1	V_1 + 80:45:45 kg ha^{-1} NPK	9.75
T_2	V_1 + 90:45:45kg ha^{-1} NPK	11.43
T_3	V_1 + 100:45:45kg ha^{-1} NPK	12.78
T_4	V_2 + 80:45:45 kg ha^{-1} NPK	11.16
T_5	V_2 + 90:45:45 kg ha^{-1} NPK	9.48
T_6	V_2 + 100:45:45kg ha^{-1} NPK	12.10
T_7	V_3 + 80:45:45 kg ha^{-1} NPK	10.78
T_8	V_3 + 90:45:45 kg ha^{-1} NPK	10.02
T_9	V_3 + 100:45:45 kg ha^{-1} NPK	13.43
	F-test	S
	S. Ed. (±)	0.001
	C. D. (P = 0.05)	0.003

Table.7 Response of hybrid and different levels of nitrogen on yield and yield attributes of pearlmillet

	Treatment	Ear Plant^{-1}	Length of Ear	No of Grains per Ear	Test weight (gm)	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Harvest index (%)
T_1	V_1 + 80:45:45 kg ha^{-1} NPK	1.37	22.77	2132.73	8.68	2.47	4.62	19.64
T_2	V_1 + 90:45:45kg ha^{-1}NPK	1.74	21.43	2062.00	8.25	2.78	5.33	23.03
T_3	V_1 + 100:45:45kg ha^{-1} NPK	2.03	24.62	2256.26	9.23	3.14	6.45	25.01
T_4	V_2+ 80:45:45 kg ha^{-1}NPK	1.69	22.94	1963.00	8.12	2.76	5.05	19.01
T_5	V_2 + 90:45:45 kg ha^{-1} NPK	1.44	22.28	1928.88	8.04	2.47	4.95	20.00
T_6	V_2 + 100:45:45kg ha^{-1} NPK	2.01	24.06	2166.92	9.18	3.02	6.26	23.68
T_7	V_3+ 80:45:45 kg ha^{-1} NPK	1.63	22.44	2070.67	8.39	2.53	5.93	21.37
T_8	V_3 + 90:45:45 kg ha^{-1} NPK	1.74	21.16	2138.80	8.81	3.01	5.44	22.85
T_9	V_3 + 100:45:45 kg ha^{-1} NPK	2.37	27.52	2406.49	10.29	3.72	6.98	25.07
	F-test	S	S	S	S	S	S	S
	S. Ed. (±)	0.229	1.08	84.91	0.589	0.350	0.608	1.790
	C. D. (P = 0.05)	0.486	2.289	180.02	1.249	0.743	1.290	3.795

Number of grains ear^{-1}

The result revealed that there was significant difference between the treatments and maximum number of grains (2406.49 ear^{-1}) was observed by the application ofV3 + 100:45:45 kg ha^{-1} NPK *i.e.*, T9, whereas the lowest value 1928.88 ear^{-1} was observed in treatment T5 *i.e.*, V2 + 90:45:45 kg ha^{-1} NPK. However, treatment, T3 *i.e.*, V1 + 100:45:45kg ha^{-1} NPK, was found statistically at par with T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK.

Test weight (g)

The result revealed that there was significant difference between the treatments and maximum test weight (10.29 g) was observed by the application of T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK. Whereas the lowest value 8.04 g was observed in treatment T5 *i.e.*, V2 + 90:45:45 kg ha^{-1} NPK. However, treatment, T3 *i.e.*, V1 + 100:45:45kg ha^{-1} NPK, T6 *i.e.*, V2 + 100:45:45kg ha^{-1} NPK was found statistically at par with T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK.

Grain yield (t ha^{-1})

The result revealed that there was significant difference between different treatments and maximum grain yield (3.72 t ha^{-1}) was observed by the application in T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK, whereas the lowest value 2.47 t ha^{-1} was observed in treatment T5 *i.e.*, V2 + 90:45:45 kg ha^{-1} NPK and T1 *i.e.*, V1 + 80:45:45 kg ha^{-1} NPK. However, treatment, T3 *i.e.*, V1 + 100:45:45kg ha^{-1} NPK, T6 *i.e.*, V2 + 100:45:45kg ha^{-1} NPK was found statistically at par with T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK.

Straw yield (t ha^{-1})

The result revealed that there was significant difference between different treatments and maximum straw yield (6.98 t ha^{-1}) was observed by the application in T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK, whereas the lowest value 4.62 t ha^{-1} was observed in treatment T1 *i.e.*, V1 + 80:45:45 kg ha^{-1} NPK. However, treatment, T3 *i.e.*, V1 + 100:45:45kg ha^{-1} NPK, T6 *i.e.*, V2 + 100:45:45kg ha^{-1} NPK was found statistically at par with T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK.

Harvest index (%)

The result revealed that there was significant difference between the treatments and maximum harvest index (25.07%) was observed by the application in T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK, whereas the lowest value 19.01% in T4 *i.e.*, V 2+ 80:45:45 kg ha-1NPK N1. However, treatment, T3 *i.e.*, V1 + 100:45:45kg ha^{-1} NPK, T6 *i.e.*, V2 + 100:45:45kg ha^{-1} NPK, T2 *i.e.*, V1 + 90:45:45kg ha- 1NPK, T8 *i.e.*, V3 + 90:45:45 kg ha^{-1} NPK and T7 *i.e.*, V 3+ 80:45:45 kg ha^{-1} NPK was found statistically at par with T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK. Saini and Negi (1996), Munirathnam *et al.*, (2006), observed that the highest harvest index was recorded in different varieties due to increased levels of nitrogen with 25 kg N ha^{-1} which was however, comparable with no nitrogen application in foxtail millet (*Setaria italica* L.). The probable reasons for recording significantly increase in grain and straw yields were observed with increase in nitrogen levels from 0 to 50 kg N ha^{-1}. The lowest grain and straw yields were recorded with no nitrogen application in foxtail millet (Setaria italica L.) Saini and Negi (1996), Munirathnam *et al.*, (2006) (Table 7).

Among the response of different hybrids to levels of nitrogen, treatment T9 *i.e.*, V3 + 100:45:45 kg ha^{-1} NPK, recorded maximum plant height (175.30cm), number of tillers plant^{-1} (3.67), dry weight (47.73g), crop growth rate (1.53 g m-2 day^{-1}), relative growth rate (0.052 g g^{-1} day^{-1}), number of ear

plant^{-1} 2.37, length of ear (27.52cm), number of Grains ear^{-1} (2406.49), test weight (10.29g), grain yield (3.72 t ha^{-1}), straw yield (6.98 t ha^{-1}), protein content (13.43%) and harvest index (36.15%). Whereas the lowest value in terms of plant height (164.47cm), number of tillers (2.60 plant^{-1}), dry weight (40.80g) (Table 3), crop growth rate (1.30 g m^{-2} day^{-1}) (Table 4), relative growth rate (0.045 g g^{-1} day^{-1}) (Table 5), number of ear (1.37 plant^{-1}), grain yield (2.47 t ha^{-1}) and straw yield (4.62 t ha^{-1}) was observed in the treatment T1 *i.e.*, V1 + 80:45:45 kg ha^{-1} NPK). Further, ear length of (21.16cm) was observed in the treatment T8 *i.e.*, V3 + 90:45:45 kg ha^{-1} NPK). In terms of number of grains (2406.49 ear^{-1}), test weight (8.04 g) was recorded in the treatment T5 *i.e.*, V2 + 90:45:45 kg ha^{-1} NPK). Further, protein content (9.48%) (Table 6) was observed in the treatment T5 *i.e.*, V2 + 90:45:45 kg ha^{-1} NPK) and harvest index (19.01%) respectively in the treatment T4 *i.e.*, V 2+ 80:45:45 kg ha^{-1} NPK).

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