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Effect of Pearl Millet (*Pennisetum glaucum* L.) to Split Application of Nitrogen at Different Stages under Irrigated Conditions

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experimentation was conducted at carried out during *kharif* 2022 at research farm, Vivekananda Global University, Jaipur. The objectives were to study the effect of nitrogen and split application of nitrogen on growth and productivity of pearl millet. The experiment consisted of 9 treatment combinations comprising three levels of nitrogen (100% RDN (60 kg N/ha), 125% RDN (75 kg N/ha) and 150% RDN (90 kg N/ha) with three levels of split application of nitrogen (Full dose of N at sowing, ½ N at sowing + ½ N at tillering (20-25 DAS) and 1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS)). The experiment was laid out in split plot design and replicated thrice. The result revealed that levels of nitrogen significantly influenced highest plant

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height (cm), dry matter accumulation at different stages, chlorophyll content in leaf at 60 DAS, number of effective tillers per plant, length of ear, test weight, grain, stover, biological yields, NPK content and their uptake and protein content with the application of 125% RDN (75 kg N/ha) over 100% RDN (60 kg N/ha). Significantly higher net return (Rs 56315/ha) and highest B:C ratio (2.03) were also obtained with 125% RDN (75 kg N/ha). Further, the split application of nitrogen significantly influenced plant height (cm), dry matter accumulation, chlorophyll content in leaf at 60 DAS, number of effective tillers per plant, length of ear, test weight, grain, stover, biological yields, NPK content and their and protein content with the application of 1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) over full dose of N at sowing and ½ N at sowing + ½ N at tillering (20-25 DAS). This treatment also increased significantly net return (Rs 67552/ha) and B:C ratio (2.45) rest of the treatments

Keywords: Pearl millet; RDN; nitrogen; growth parameters; yield; economics.

1. INTRODUCTION

Pearl millet [*Pennisetum glaucum* (L.) R. Br. Emend Stuntz] is one of the most important drought tolerant crops. It is considered as the principal food grain and fodder crop among millets. It is widely distributed across the arid and semi-arid tropics of Africa and Asia because of its tolerance to difficult growing conditions such as drought, low soil fertility and high temperature [1-3]. Pearl millet is mostly grown as rain fed crop on marginal and sub-marginal land, poor in organic matter, low in available nitrogen, phosphorus and micronutrients, which results in low productivity. It is the fourth most important food crop after rice, wheat and maize. In India, it occupies an area of 7.57 million ha with production of 10.86 million tons and productivity of 1436 kg/ha (Directorate of Economics & Statistics, DAC & FW, 2020-21) [4-6]. The major pearl millet growing states are Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana which account for more than 90% of pearl millet acreage in country. Among the states, Rajasthan has biggest share of 4.32 million ha (57.10% of total area of India) with production and productivity of 4.53 million tonnes (41.71% of total production of India) and of 1049 kg/ ha respectively (Directorate of Economics & Statistics, DAC & FW, 2018-19). It is mainly cultivated in Jodhpur, Barmer, Jalore, Nagaur, Churu, Jaipur, Sikar, Alwar and Jhunjhunu districts in Rajasthan [7,8]. Pearl millet is adopted to stress intensive environment, yet it is highly versatile, input responsive and high-quality cereal with great potential to become a valuable component of non– traditional season like summer under irrigated and high input management conditions. Pearl millet is a dual-purpose crop as its grain is used for human consumption and its fodder as cattle feed [9-12].

The nutrient content of pearl millet grains is very well comparable with other cereals and millets. It has high protein content with slightly superior amino acid profile. It contains about 12.4% moisture, 11.6% protein, 5% fat, 67% carbohydrates, 2.7% mineral matter and gives 361 kilo calories per 100 g with high amount of vitamin A and B. It imparts substantial energy to the body with easy digestibility [13-16]. Pearl millet is rich in vitamins B, potassium, phosphorus, magnesium, iron, zinc, copper and manganese. It is gluten free grain and is the only grain that retains its alkaline properties after being cooked which is ideal for people with pearl millet allergy (Chauhan et al. 2015). Due to the excellent nutritional properties and resilience to climate change, pearl millet along with other millets is renamed as nutricereal (Gazette of India, No. 133 dated 13th April, 2018) for production, consumption and trade and included in public distribution system.

Nitrogen is essential for plant growth (Liu *et al*., 2014) and involved in important syntheses and formation of many important substances and compounds plant such as amino acids, enzymes, DNA, RNA and chlorophyll (Khalil *et al*., 2016), therefore it must be available for plants in adequate amounts. Nitrogen being a major food for plants is an essential constituent of protein (build from amino acids that involves in catalization of chemical response and transportation of electrons) and chlorophyll (enable the process of photosynthesis) present in many major portions of the plant body [17,18].

The use of excess chemical fertilizers can result in environmental contamination while applying biological and fertilizers can increase soil fertility, crop production, and at the same time prevent environmental pollutions (De Rosa *et al*., 2010). To avoid application of excessive rates of N to crops, particularly the edible leafy ones, foliar spray of N as urea is preferred (Mondal and Al-Mamun, 2011), particularly a technique which proved effective for plant nutrition due to its high absorption and utilization efficiency by plants (Mondal and Mamun, 2011 and Manjunatha *et al*., 2016).

2. MATERIALS AND METHODS

A field experiment was conducted at research farm, Vivekananda Global University, Jaipur during *kharif* seasons of the years 2022. The details of experimental techniques, materials used and criteria adopted for evaluation of treatments during the course of present investigation are described in this chapter. The experiment was laid out at Agronomy Farm, Vivekananda Global University, Jaipur during *kharif* seasons of 2022. Jaipur is situated at 260 5" North latitude and 750 28" East longitudes at an altitude of 427 meters above mean sea level. In Rajasthan, this region falls under Agro-climatic zone-IIIA (Semi-Arid Eastern Plains). The climate of this region is typically semi-arid, characterized by extremes of temperature during both summer and winter. The average annual rainfall of this tract varies from 300 mm to 400 mm and is mostly received during the months of July to September. During summer, temperature may goes high as 46^0C while in winter, it may fall as low as -1.5^0C. There is hardly any rain during winter and summer. The maximum and minimum temperatures during the crop season ranged between 30.2^0C to 35.2^0C and 16.8^0C to 23.0^0C, respectively. A total of 350.0 mm rainfall was recorded during the cropping season. The mean relative humidity fluctuated between 40 to 70 per cent, while the average sunshine hours ranged between 2.9 to 9.7 hrs/day.

All agronomic practices are followed in order in the crop period. Experimental data collected was subjected to statistical analysis by adopting Fisher's method of analysis of variance (ANOVA) as outlined by Gomez and Gomez (1984). Critical Difference (CD) values were calculated wherever the 'F' test was found significant at 5 percent level.

3. RESULTS AND DISSCUSSION

3.1 Growth Parameters

3.1.1 Plant population m^{-1} row length

Data presented in Table 1 showed that plant stand of pearl millet per metre row length at 20 DAS and at harvest remained unaffected by application of nitrogen and Split application of nitrogen which shows uniform plant stand.

3.1.2 Plant height (cm)

Revealed that nitrogen levels significantly enhanced the plant height at different stages of pearl millet. Application of N2 i.e., 125% RDN recorded the maximum plant height at 20, 40, 60 DAS and at harvest of pearl millet which remained at par with N3 i.e.,150% RDN which were recorded an increase of 19.19, 12.38, 10.37 and 8.89 per cent at 20, 40, 60 DAS and at harvest, over over N1 i.e., 100% RDN, respectively.

The data pertaining to plant height at different stages of pearl millet at harvest as influenced due to split nitrogen application are presented in Table 2. The data indicated that plant height of pearl millet at 20, 40, 60 DAS and at harvest were affected significantly by split nitrogen level i.e., S3- 1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35- 40 DAS) as compared to S1-Full dose of N at sowing and S2-½ N at sowing + ½ N at tillering (20-25 DAS). The increase in plant height of pearl millet due to Split nitrogen level i.e., S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS was 26.46, 11.61 per cent at 20 DAS, 18.65, 7.60 per cent at 40 DAS, 15.23, 4.79 per cent at 60 DAS and 14.93, 5.43 per cent at harvest, respectively over S1-Full dose of N at sowing and S2-½ N at sowing + ½ N at tillering (20-25 DAS).

3.1.3 Dry matter accumulation

revealed that nitrogen levels significantly enhanced the dry matter accumulation at different stages of pearl millet. Application of N2 i.e., 125% RDN recorded the maximum dry matter at 20, 40, 60 DAS and at harvest of pearl millet which remained at par with N3 i.e.,150% RDN (90 kg N/ha) which were recorded an increase of 16.46, 18.73, 20.41 and 11.93 per cent at 20, 40, 60 DAS and at harvest, over over N1 i.e., 100% RDN, respectively.

The data pertaining to dry matter at different stages of pearl millet at harvest as influenced due to split nitrogen application are presented in Table 3. The data indicated that dry matter of pearl millet at 20, 40, 60 DAS and at harvest were affected significantly by split nitrogen level i.e., S3- 1/3 N at sowing + 1/3 N at tillering (20-

25 DAS) + 1/3 N at boot stage (35-40 DAS) as compared to S1-Full dose of N at sowing and S2-½ N at sowing + ½ N at tillering (20-25 DAS). The increase in dry matter of pearl millet due to Split nitrogen level i.e., S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS was 23.57, 9.41 per cent at 20 DAS, 30.90, 8.19 per cent at 40 DAS, 27.70, 10.99 per cent at 60 DAS and 16.14, 6.43 per cent at harvest, respectively over S1-Full dose of N at sowing and S2-½ N at sowing + ½ N at tillering (20-25 DAS).

3.1.4 Chlorophyll content at 60 DAS

An examination of data indicated that total chlorophyll content of leaves at 60 DAS differ significantly due to application of N2 i.e.,125% RDN in pearl millet crop. Application of 125% RDN registered a higher chlorophyll content of 3.11 mg/g over preceding levels. It resulted into an increased chlorophyll content of 9.89 per cent at 60 DAS over N1-100% RDN, respectively which was remained at par with N3-150% RDN.

The data pertaining to chlorophyll content in leaf at 60 DAS of pearl millet as influenced due to 1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) are presented in Table 5. The data indicated that chlorophyll content in leaf of pearl millet was affected significantly by 1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) as compared to S2-½ N at sowing + ½ N at tillering (20-25 DAS) and S1-Full dose of N at sowing. The increase in chlorophyll content due to 1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) (S3) was 16.20 and 6.80 per cent, respectively over S1 and S2, respectively.

3.2 Yield Parameters

3.2.1 Number of effective tillers per plant

A critical examination of data showed that successive increase in N2-125% RDN level, increased number of effective tillers per plant of pearl millet significantly over N1-100% RDN (60 kg N/ha) and remained at par with N3-150% RDN. Application of N2-125% RDN significantly increased the number of effective tillers per plant of pearl millet by 14.83 per cent over N1100% RDN.

A critical examination of data showed that successive increase in S3-1/3 N at sowing + 1/3 N at tillering (20- 25 DAS) + 1/3 N at boot stage (35-40 DAS) level, increased chlorophyll content of pearl millet significantly over S2-½ N at sowing + ½ N at tillering (20-25 DAS) and S1-Full dose of N at sowing. The magnitude of increase in chlorophyll content in leaf of pearl millet due to S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) was 24.40 and 8.79 per cent over S1 and S2, respectively.

3.2.2 Length of ear (cm)

The data presented in Table 5 showed that successive increase in N2-125% RDN level, increased length of ear of pearl millet significantly over N1-100% RDN and remained at par with N3-150% RDN (90 kg N/ha). Increase in N2-125% RDN significantly increased the length of ear over N1. The magnitude of increase in ear length due to N2-125% RDN (75 kg N/ha) was 17.54 per cent over N1-100% RDN.

A critical examination of data presented in Table 5 showed that split nitrogen application increase in S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) level, increased length of ear of pearl millet significantly over S2-½ N at sowing + ½ N at tillering (20-25 DAS) and S1-Full dose of N at sowing. The magnitude of increase in length of ear of pearl millet due to S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) was 23.76 and 9.41 per cent over S1 and S2, respectively

3.2.3 Grain yield

A close perusal of data revealed that successive increase in nitrogen levels upto 125% RDN (N2) significantly improved the grain yield of pearl millet as compared to N1-100% RDN. Beyond this level, grain yield of pearl millet increases but not reached at level of significance. The application of N2-125% RDN produced significantly higher grain yield (1686 kg/ha) of pearl millet while remained at par with application of N3-150% RDN (1823 kg/ha) and found significantly superior over N1-100% RDN (1249 kg/ha). The increase in grain yield of pearl millet due to application of N2-125% RDN was 34.99 per cent over N1-100% RDN.

A critical examination of data revealed that split nitrogen applications were caused significant difference in grain yield of pearl millet. Split nitrogen level i.e., S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) resulted significantly highest grain yield (1898 kg/ha) as compared to S1-Full dose of N at sowing (1239 kg/ha) and S2-½ N at sowing + ½ N at tillering (20-25 DAS) (1619 kg/ha). The improvement in grain yield of pearl millet by split nitrogen level i.e., 1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) (S3) was 52.94 and 17.23 per cent over S1 and S2, respectively

3.2.4 Stover yield

A perusal of data revealed that successive increase in nitrogen levels up to 125% RDN significantly improved the stover yield of pearl millet as compared to 100% RDN. Beyond this level, stover yield of pearl millet increases but not reached at level of significance. The application of N2-125% RDN produced significantly higher stover yield (4701 kg/ha) of pearl millet while remained at par with application of 150% RDN (5318 kg/ha) and found significantly superior over 100% RDN (3398 kg/ha). The increase in stover yield of pearl millet due to application of 125% RDN was 38.35 per cent over 100% RDN.

A critical examination of data revealed that split nitrogen applications were caused significant difference in stover yield of pearl millet. Split nitrogen level i.e., S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) resulted significantly highest stover yield (5341 kg/ha) as compared to S1-Full dose of N at sowing (3562 kg/ha) and S2-½ N at sowing + ½ N at tillering (20-25 DAS) (4514 kg/ha). The improvement in stover yield of pearl millet by split nitrogen level i.e.,1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) (S3) was 49.94 and 18.32 per cent over S1 and S2, respectively.

3.2.5 Biological yield

The data stated that biological yield of pearl millet was significantly improved due to different nitrogen levels. The application of N2-125% RDN gave biological yield of 6387 kg/ha which was found significantly higher than N1-100% RDN (4647 kg/ha) which was at par with N2-125% RDN (1741 kg/ha). The enhancement in biological yield of pearl millet due to application of 125% RDN was in the order of 37.44 per cent over N1-100% RDN.

A critical examination of data showed that split nitrogen applications had significant impact on biological yield of pearl millet. The highest biological yield (7239 kg/ha) was obtained by S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) which was found significantly higher than S1-Full dose of N at sowing and S2- ½ N at sowing + ½ N at tillering (20-25 DAS). The corresponding increase in biological yield by pearl millet due to S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) was 50.72 and 18.03 per cent, respectively over S1-Full dose of N at sowing and S2-½ N at sowing + ½ N at tillering (20-25 DAS) , respectively.

3.2.6 Harvest index (%)

An examination of data indicated that the application of different levels of nitrogen did not bring any significant effect on harvest index of pearl millet. Split nitrogen application the critical scrutiny of data revealed that the effect of split nitrogen application on harvest index of pearl millet was found to be non-significant.

3.3 Economics

3.3.1 Net returns (Rs/ha)

Nitrogen level A critical examination of data revealed that different nitrogen fertilizer levels significantly increased the net returns of pearl millet. The significantly higher net returns (56315/ha) of pearl millet were obtained with the application of N2-125% RDN which were closely followed then application of N3-150% RDN (65938/ha) and proved significantly higher than N1-100% RDN (33931/ha). The application of N2- 125% RDN provided additional net returns of 22384/ha in comparison to N1-100% RDN. Split nitrogen application It is evident from the data that net returns of pearl millet were influenced to a great extent due to split nitrogen applications. Significantly highest net returns (67552/ha) was obtained by S3- 1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) which was significantly higher over S1-Full dose of N at sowing (35128/ha) and S2-½ N at sowing + ½ N at tillering (20-25 DAS) (53504/ha). Split nitrogen application upto S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) gave additional net returns of 32424 and 18376 in comparison to S1-Full dose of N at sowing and S2-½ N at sowing + ½ N at tillering (20-25 DAS), respectively.

Table 1. Effect of split application of nitrogen at different stages on plant stand of pearl millet

Treatments	Plant population m-1 row length	
	20 DAS	At harvest
Nitrogen levels		
N1-100% RDN (60 kg N/ha)	8.93	8.85
N2-125% RDN (75 kg N/ha)	9.13	9.09
N3-150% RDN (90 kg N/ha)	9.63	9.57
SEm±	0.27	0.36
CD (P=0.05)	NS	NS
CV (%)	8.85	11.89
Nitrogen split application		
S1-Full dose of N at sowing	8.99	8.91
S2-½ N at sowing + ½ N at tillering (20-25 DAS)	9.15	9.11
S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 Nat boot stage (35-40 DAS)	9.55	9.49
SEm±	0.25	0.22
CD (P=0.05)	NS	NS
CV (%)	8.08	7.28

Table 2. Effect of split application of nitrogen at different stages on plant height at different stages of pearl millet

Treatments	Plant height (cm)			
	20 DAS	40 DAS	60 DAS	At harvest
Nitrogen levels				
N1-100% RDN (60 kg N/ha)	19.80	69.38	137.02	164.61
N1-125% RDN (75 kg N/ha)	23.60	77.97	151.23	179.25
N1-150% RDN (90 kg N/ha)	25.04	79.97	154.82	182.96
SEm±	0.64	1.75	3.35	4.18
CD (P=0.05)	2.52	6.86	13.17	16.42
CV (%)	8.44	6.92	6.81	7.14
Nitrogen split application				
S1-Full dose of N at sowing	20.14	69.11	136.25	162.63
S2-½ N at sowing + ½ N at tillering (20- 25 DAS)	22.82	76.21	149.82	177.28
S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35- 40 DAS)	25.47	82.00	157.00	186.91
SEm±	0.525	1.263	2.029	2.760
CD (P=0.05)	1.62	3.89	6.25	8.50
CV (%)	6.90	5.00	4.12	4.71

Table 3. Effect of split application of nitrogen at different stages on dry matter accumulation at different stages of pearl millet

Treatments	Dry matter accumulation (g/plant)			
	20 DAS	40 DAS	60 DAS	At harvest
Nitrogen levels				
N1-100% RDN (60 kg N/ha)	8.08	17.83	25.62	65.86
N1-125% RDN (75 kg N/ha)	9.41	21.17	30.85	73.72
N1-150% RDN (90 kg N/ha)	10.07	22.32	33.50	77.85
SEm±	0.24	0.67	0.93	1.47
CD (P=0.05)	0.96	2.65	3.65	5.79
CV (%)	7.98	9.90	9.30	6.10

Treatments	Dry matter accumulation (g/plant)			
	20 DAS	40 DAS	60 DAS	At harvest
Nitrogen split application				
S1-Full dose of N at sowing	8.19	18.12	26.25	66.85
S2-½ N at sowing + ½ N at tillering (20- 25 DAS)	9.25	20.75	30.20	72.95
S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS)	10.12	22.45	33.52	77.64
SEm±	0.211	0.414	0.654	1.167
CD (P=0.05)	0.65	1.27	2.02	3.60
CV (%)	6.89	6.07	6.54	4.83

Table 4. Effect of split application of nitrogen at different stages on chlorophyll content at 60 DAS of pearl millet

Treatments	Chlorophyll content at 60 DAS (mg/g)
Nitrogen levels	
N1-100% RDN (60 kg N/ha)	2.83
N1-125% RDN (75 kg N/ha)	3.11
N1-150% RDN (90 kg N/ha)	3.30
SEm±	0.07
CD (P=0.05)	0.26
CV (%)	6.46
Nitrogen split application	
S1-Full dose of N at sowing	2.84
S2-½ N at sowing + ½ N at tillering (20-25 DAS)	3.09
S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS)	3.30
SEm±	0.057
CD (P=0.05)	0.17
CV (%)	5.52

Table 5. Effect of split application of nitrogen at different stages on number of effective tillers per plant, length of ear and test weight of pearl millet

Treatments	Number of effective tillers per plant	Length of ear (cm)	Test weight (g)
Nitrogen levels			
N1-100% RDN (60 kg N/ha)	2.09	19.95	5.44
N1-125% RDN (75 kg N/ha)	2.40	23.45	6.44
N1-150% RDN (90 kg N/ha)	2.60	24.95	6.84
SEm±	0.07	0.55	0.17
CD (P=0.05)	0.26	2.16	0.66
CV (%)	8.42	7.24	8.14
Nitrogen split application			
S1-Full dose of N at sowing	2.09	20.29	5.21
S2-½ N at sowing + ½ N at tillering (20-25 DAS)	2.39	22.95	6.36
S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS)	2.60	25.11	7.15
SEm±	0.054	0.489	0.130
CD (P=0.05)	0.17	1.51	0.40
CV (%)	6.84	6.44	6.23

Table 6. Effect of split application of nitrogen at different stages on grain, stover, biological yields and harvest index of pearl millet

Treatments	Grain yield (kg/ha)	Stover yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
Nitrogen levels				
N1-100% RDN (60 kg N/ha)	1249	3398	4647	26.85
N2-125% RDN (75 kg N/ha)	1686	4701	6387	26.37
N3-150% RDN (90 kg N/ha)	1823	5318	7141	25.50
SEm±	48	166	247	0.66
CD (P=0.05)	187	653	968	NS
CV (%)	9.01	11.16	12.21	7.58
Nitrogen split application				
S1-Full dose of N at sowing	1241	3562	4803	25.93
S2-½ N at sowing + ½ N at tillering (20-25 DAS)	1619	4514	6133	26.49
S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS)	1898	5341	7239	26.31
SEm±	37	98	173	0.572
CD (P=0.05)	113	303	533	NS
CV (%)	6.96	6.60	8.56	6.53

Table 7. Effect of split application of nitrogen at different stages on N content in grain and stover and their uptake of pearl millet

Treatments	N content (%)		N uptake (kg/ha)	
	Grain	Stover	Grain	Stover
Nitrogen levels				
N1-100% RDN (60 kg N/ha)	1.253	0.292	16.07	10.20
N2-125% RDN (75 kg N/ha)	1.720	0.382	29.78	18.41
N3-150% RDN (90 kg N/ha)	1.838	0.424	34.40	23.15
SEm±	0.033	0.012	1.21	0.68
CD (P=0.05)	0.129	0.045	4.77	2.66
CV (%)	6.149	9.50	13.61	11.80
Nitrogen split application				
S1-Full dose of N at sowing	1.285	0.291	16.33	10.64
S2-½ N at sowing + ½ N at tillering (20-25 DAS)	1.615	0.371	26.78	17.20
S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35- 40 DAS)	1.910	0.436	37.13	23.91
SEm±	0.019	0.009	0.60	0.54
CD (P=0.05)	0.059	0.029	1.85	1.68
CV (%)	3.568	7.68	6.72	9.47

Table 8. Effect of split application of nitrogen at different stages on net returns and B:C ratio of pearl millet

Treatments	Net returns (Rs/ha)	B:C ratio
Nitrogen levels		
N1-100% RDN (60 kg N/ha)	33931	1.23
N2-125% RDN (75 kg N/ha)	56315	2.03
N3-150% RDN (90 kg N/ha)	65938	2.42
SEm±	2963	0.12
CD (P=0.05)	9800	0.39
CV (%)	11.89	11.76

Treatments	Net returns (Rs/ha)	B:C ratio
Nitrogen split application		
S1-Full dose of N at sowing	35128	1.26
S2-½ N at sowing + ½ N at tillering (20-25 DAS)	53504	1.97
S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS)	67552	2.45
SEm±	1711	0.05
CD (P=0.05)	5272	0.16
CV (%)	9.86	8.40

4. CONCLUSION

Considering the results obtained from the present investigation, it may be concluded that: -

Application of nitrogen at 125% RDN (75kg/ha) proved to be the most suitable dose as it gave significantly higher grain yield (1686 kg/ha), stover yield (4701 kg/ha), net returns (Rs 56315 /ha) and B:C ratio (2.03) over 100% RDN (50kg/ha) from pearl millet crop.

Split application of nitrogen i.e., S3-1/3 N at sowing + 1/3 N at tillering (20-25 DAS) + 1/3 N at boot stage (35-40 DAS) are proved superior to obtained significantly higher grain yield of1898 kg/ha, net return (Rs 67552/ha) and B:C ratio (2.45) of pearl millet over 100%RDN. However, these results are only indicative and require further experimentation for more years to derive credible conclusion.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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