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To response on yield and economics under nutrient management and moisture conservation practice treatments on Pearlmillet (*Pennisetum glaucum* L.) under light textured soil

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Abstract
A field experiment was conducted on pearlmillet during Kharif, 2019-20 and 2020-21 at Soil Conservation and Water Management Farm of the Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Uttar Pradesh with six nutrient management N_1) Control, N_2) 100% NPK 80:40:40 kg ha^{-1} through RDF, N_3) Green manuring + 75% NPK through RDF, N_4) Green manuring + FYM 10 t ha^{-1}, N_5) FYM@ 10 t ha^{-1} + 75% NPK through RDF and N_6) FYM@ 10 t ha^{-1} + 50% NPK through RDF) and three moisture conservation practices, M_1) Control, M_2) inter-row water harvesting and M_3) Ridge making at 25 DAS)in Factorial randomized block design with three replication. The results of experimental revealed that N_5) FYM@ 10 t ha-^{1} + 75% NPK through RDF nutrient management treatment gave significantly highest production of grain yield (22.39 and 24.01q ha^{-1}), stover yield (55.21 and 59.38q ha^{-1}) and biological yield (86.95 and 93.40 q ha^{-1}) earned maximum gross return (57698 and 65494 Rs. ha^{-1}) and net return (24964 and 31892 Rs ha^{-1}) and B:C ratio (1:1.61 and 1:1.70) while minimum grain yield (q ha^{-1}) (11.98 and 12.78), stover yield (q ha^{-1}) (36.16 and 39.94) and biological yield (q ha^{-1}) (48.98 and 52.72) earned the minimum gross income (Rs. ha^{-1}) (31185 and 35420), net return (Rs. ha^{-1}) (8123 and 10683) and B:C ratio (1:1.35 and 1:1.43) calculated under the (M_1) control treatment during both the experimental years.

Keywords: Grain yield (q ha^{-1}), stover yield (q ha^{-1}), biological yield (q ha^{-1}) gross return (Rs. ha^{-1}), Net return (Rs. ha^{-1}) and B:C ratio

Introduction
Pearlmillet is one of the important millet crops of hot and dry area of arid and semi-arid climatic condition. It has been estimated that pearlmillet embodies a tremendous productivity potential particularly in area having extreme environmental stress condition an account of drought and highest drought tolerant crop. Among cereals and millets water requirement for pearlmillet is very low (250-500mm) but sensitive to water logging. The moisture conservation practices have been well recognized means of conservation of moisture through furrow sowing method under rainfed condition. Soil moisture conservation is most important concern of rainfed Agriculture in *Kharif* season.

Effective green manuring in rainfed area leads to increasing availability of soil moisture and reduce the transpiration loss. The sowing methods enhance the crop growth, yield attributes and water use efficiency of pearlmillet crop. The moisture conservation practices may help the farming community to realize the potential yield of pearlmillet. Pearlmillet is commonly known as Bajra belongs to Family- Gramineae (Poaceae) and origin place is Africa. Pearlmillet is one of the major coarse grain crops and is to be considering a poor men's food. Jakhar *et al.* (2018) [2];

Pearl millet is predominantly grown in North West India and accounts for 42% of total world area under pearl millet and shares 24% of coarse grains production (Anonymous, 2013-14). In India is the largest producer of this crop both in term of area 9.1 mha and production (7.41mha) and production (10.3mt) with an average productivity of 1391 kg ha-^{1} during 2019-20. Bagla *et al.* (2008) [3] As compared to the early 1980s, the pearlmillet area in India decline by 26% during the 2015 - 2016, but production increased by 19% owing to 44% increase in productivity. Three years moving average for pearlmillet, production, and yield, and number of variety based on (ICRISAT – *bred material in India*).

The major pearlmillet growing states in India are Rajasthan, UP, Haryana, Gujarat, and Maharashtra. In area of the pearlmillet is Rajasthan fallowed by Maharashtra, Gujarat and Uttar Pradesh about 3.2 mha, 1.55 mha, 0.94 mha, and 0.7 mha respectively but in productivity Haryana fallowed by Gujarat and Uttar Pradesh about 1331 kg ha-^{1}, 1277 kg ha-^{1} and 1235 kg ha-^{1} respectively. Sewhag *et al.* (2003) [4]; Hirooka *et al.* (2021) [5]

Materials and Methods

A field experiment entitled "To response on yield and economics under nutrient management and moisture conservation practice treatments on Pearlmillet (*Pennisetum glaucum* L.) under light textured soil." was conducted during *Kharif* season of 2019-20 and 2020-21 at Soil Conservation and Water Management Farm of the Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The materials used and methods employed during field experimentation and laboratory estimations have been described in this chapter. Geographically Kanpur is situated at an elevation of 129 meter above mean sea level, it lines between 25^{0}26' and 26^{0}58' North latitude and 79^{0}31' and 80^{0}34' East longitude. It is situated in the alluvial tract of Indo-Gangetic plain zone of Central Uttar Pradesh, which comes under Agro-climatic zone IV. Normally the climate of this zone is semi-arid with hot summer, moderate rainfall and cold winter. The average annual rainfall of this zone is about 800 mm, mainly through south-west monsoon rains confined within June to last week of September with occasional showers in winter season from North-East monsoon during December and January.

Treatments and field management

The threshing was done by manually and then seed yield of each plot was weighed. The seed yield of each net plot which was recorded and later on converted into q ha^{-1}. Similar procedure was adopted for all experimental crops. The Stover yield was worked out after deducting the seed yield from the total biomass production for each plot. It was then calculated in q ha^{-1}. The crop from the net plot area was harvested and dried in sun for 2-3 days in respective plots. It was weighted to record the biological yield and expressed in q ha^{-1}. Hirooka *et al.* (2021) [5]

Gross profit was calculated by multiplying the grain/seed and straw yield ha^{-1} with the prevailing market prices of seed and straw. The relative figures of cost of cultivation for each treatment were deducted from gross profit of the corresponding treatments for calculating net return (Rs ha^{-1}).

Statistical Analysis

The data collected during the experimental period and after the completion of the experiment were statistically analyzed with the help of the following statistical techniques. Since, the experiment was conducted in Split Plot Design with 3 replications with two factor i.e. cropping systems and integrated nutrient management the analysis of variance of the data was worked out on the basis of Factorial Randomized Block Design. The details of the variation and the breakup of the degree of freedom have been given in the following Tables of Analysis of variance. Shekhawat *et al.* (2015) [7]

Result and Discussion

The following yield studies were same plants from which growth observations were recorded. The parameters of yield studies included Grain yield, Stover yield and Biological yield. The data recorded during 2019-20 and 2020-21 were subjected statistical analysis and summarized in the table-1.

Yield (q ha^{-1})

Effect of nutrient management

Result on grain yield (q ha^{-1}), stover yield (q ha^{-1}) and biological yield (q ha^{-1}) data given in table-1. Data on grain yield (q ha^{-1}) stover yield (q ha^{-1}) and biological yield (q ha^{-1}) clearly reveals that nutrient management significantly affect grain yield of pearlmillet. Maximum grain yield (q ha^{-1}) (22.39 and 24.01), stover yield (q ha^{-1}) (64.56 and 69.40) and biological yield (q ha^{-1}) (86.95 and 93.40) of pearlmillet was weighted under nutrient management treatment (N_5) FYM applied @ of 10 tones/ha with 75% NPK nutrient application through RDF following by (N_3) green manuring with 75% NPK through RDF during both the experimental years and highest grain yield (q ha^{-1}), stover yield (q ha^{-1}) and biological yield (q ha^{-1}) also weighted under these treatments at maturity the stages of crop growth. Minimum grain yield (q ha^{-1}) (11.98 and 12.78), stover yield (q ha^{-1}) (36.16 and 39.94) and biological yield (q ha^{-1}) (48.98 and 52.72) weighted under the (N_1) control treatment during the both the year of experimentation.

Table 1: Effect on Grain Yield (q/ha), Stover Yield (q/ha) and biological Yield (q/ha) under different treatments

Treatment	Grain Yield (q/ha)		Stover Yield (q/ha)		Biological Yield (q/ha)	
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
Nutrient Management:-						
N_1: Control	11.97	12.78	36.16	39.94	48.98	52.72
N_2: 100% NPK 80:40:40 kg ha^{-1} through RDF	17.81	19.05	52.17	56.15	69.97	75.64
N_3: Green manuring + 75% NPK through RDF	20.15	21.56	58.49	62.59	78.64	83.73
N_4: Green manuring + FYM 10 t ha^{-1}	16.98	18.17	50.5	54.03	67.48	71.99
N_5: FYM@ 10 t ha-^{1} + 75% NPK through RDF	22.39	24.01	64.56	69.4	86.95	93.4
N_6: FYM@ 10 t ha^{-1} + 50% NPK though RDF	17.2	18.43	50.36	55.28	67.56	73.72
SE±(d)	0.796	0.903	1.392	2.23	2.24	2.8
CD at (0.05%)	1.619	1.837	2.83	4.534	4.554	5.693
Moisture Conservation Practices:-						
M_1: Control	16.57	17.71	48.4	52.78	65.5	70.5
M_2: Inter-row water harvesting	17.85	19.1	52.51	56.53	70.36	75.58
M_3: Ridge making at 25 DAS	18.84	20.19	55.91	59.38	73.93	79.52
SE±(d)	0.563	0.639	0.985	1.577	1.584	1.98
CD at (0.05%)	1.145	1.299	2.001	3.206	3.22	4.025

Effect of moisture conservation practice

Data on grain yield (q ha^{-1}), stover yield (q ha^{-1}) and biological yield (q ha^{-1}) clearly reveals that moisture conservation practice significantly affects grain yield (q ha^{-1}), stover yield (q ha^{-1}) and biological yield (q ha^{-1}) of pearlmillet. Maximum grain yield (q ha^{-1}) (18.84 and 20.19), stover yield (q ha^{-1}) (55.21 and 59.38) and biological yield (q ha^{-1}) (73.93 and 79.52) of pearlmillet was recorded under moisture conservation practice treatment (M_3) ridge making at 25 DAS during 2019-20 and 2020-21. Minimum grain yield (q ha^{-1}) (16.57 and 17.71), stover yield (q ha^{-1}) (48.40 and 52.78) and biological yield (q ha^{-1}) (65.50 and 70.50) recorded under (N_1) the control treatment during both the experimental year.

Economics

Result on gross income (Rs. ha^{-1}), net return (Rs. ha^{-1}) and B:C ratio of data given in table-2.

Table 2: Effect of different treatments on gross return and net gross return under

Treatment	Gross Income		Net Income		B:C Ratio	
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
Nutrient Management:-						
N_1: Control	31185	35420	8123	10683	1:1.35	1:1.43
N_2: 100% NPK 80:40:40 kg ha^{-1} through RDF	46047	52257	16024	22469	1:1.68	1:1.75
N_3: Green manuring + 75% NPK through RDF	51992	58781	18634	26728	1:1.76	1:1.83
N_4: Green manuring + FYM 10 t ha^{-1}	44059	49824	14563	16686	1:1.41	1:1.50
N_5: FYM@ 10 t ha^{-1} + 75% NPK through RDF	57698	65494	24964	31892	1:1.84	1:1.94
N_6: FYM@ 10 t ha^{-1} + 50% NPK though RDF	44473	50460	16638	17992	1:1.46	1:1.55
SE±(d)					-	-
CD at (0.05%)					-	-
Moisture Conservation Practices:-						
M_1: Control	42812	48575	13448	19084	1:1.55	1:1.63
M_2: Inter-row water harvesting	46196	52290	17306	21195	1:1.59	1:1.67
M_3: Ridge making at 25 DAS	48718	55252	18719	22947	1:1.61	1:1.70
SE±(d)					-	-
CD at (0.05%)					-	-

Effect of nutrient management

Data on gross income (Rs. ha^{-1}), net return (Rs. ha^{-1}) and B:C ratio clearly reveals that nutrient management significantly affect the plant of pearlmillet. Maximum gross income (Rs. ha^{-1}) (57698 and 65494), net return (Rs. ha^{-1}) (24964 and 31892) and B:C ratio (1:1.84 and 1:1.94) of pearlmillet was calculated under nutrient management treatment (N_5) FYM applied @ of 10 tones/ha with 75% NPK through RDF during both the year of experimentation. Minimum gross income (Rs. ha^{-1}) (31185 and 35420), net return (Rs. ha^{-1}) (8123 and 10683) and B:C ratio (1:1.35 and 1:1.43) calculated under the (M_1) control treatment during both the experimental years.

Effect of moisture conservation practice

Data on gross income (Rs. ha^{-1}), net return (Rs. ha^{-1}) and B:C ratio clearly reveals that moisture conservation practice significantly affects the plant of pearlmillet. Maximum gross income (Rs. ha^{-1}) (48718 and 55252), net return (Rs. ha^{-1}) (18719 and 22947) and B:C ratio (1:1.61 and 1:1.70) of pearlmillet was calculated under moisture conservation practice treatment (M_3) ridge making at 25 DAS during both the experimental years while Minimum gross income (Rs. ha^{-1}) (42812 and 48575), net return (Rs. ha^{-1}) (13748 and 19084) and B:C ratio (1:1.35 and 1:1.43) calculated under the (M_1) control treatment during both the year of experimentation.

Conclusion

The results of present investigation could be concluded in the light of set objectives of the study as given below:

Significantly maximum grain yield (q ha^{-1}), straw yield (q ha^{-1}) and biological yield (q ha^{-1}) and economics *viz*., gross return (Rs ha^{-1}), net return (Rs ha^{-1}) and B:C ratio, were produced with the results of the present investigation summarized above it can be concluded under the nutrient management treatment (N_5) FYM applied @ of 10 tones/ha with 75% NPK application through RDF as compared to remaining treatments during 2019-20 & 2020-21.

Significantly maximum grain yield (q ha^{-1}), straw yield (q ha^{-1}) and biological yield (q ha^{-1}), and economics *viz*., gross return (Rs ha^{-1}), net return (Rs ha^{-1}) and B:C ratio, were produced more significant with moisture conservation practices given at treatment (M_3) ridge making at 25 DAS then other moisture conservation practices during both the experimental year.

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