Website : www.ssdatmeerut.in
Progressive Research : An International Journal
Vol 16 (1) : 24-26 (January-2021), Print ISSN : 0973-6417, Online ISSN : 2454-6003
Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) India

Relative Impact of Moisture Conservation Practices and Fertility Levels on Pearlmillet Varieties Under Rainfed Condition

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Abstract

Two varieties of pearlmillet were tested under three fertility levels and two moisture conservation practices during kharif seasons of 2013 and 2014 at Kanpur. Results revealed that the variety 'Kaveri supper boss' proved to be the most promising in yield, nutrient uptake and net return as compared to variety 'Pioneer'. Application of 80 kg N + 40 kg P_2O_5 + 40 kg K_2O ha^{-1} resulted in maximum nutrient content as well as uptake, grain as well as stover yield and net return of pearlmillet, compared with that obtained with 60 kg N + 30 kg P_2O_5 + 30 kg K_2O and 40 kg N + 20 kg P_2O_5 + 20 K_2O ha^{-1}. Ridging and furrowing in between crop rows after 20 days of sowing brought about significantly higher nutrient uptake and yield as compared to farmer's practice. Net return was also noticed more.

Key words : *Splash erosion, nutrient uptake, content, yield.*

Introduction

Pearlmillet [*Pennisetum glaucum* (L.) R.Br. emend. Stuntz] is a short duration crop well adopted to less and eratic rainfall conditions. It is grown on large scale due to its drought escaping mechanisms and lower water requirement as compared to other cereals like sorghum and maize. Its productivity is low because of use of low yielding traditional varieties, inadequate fertilization and no use of moisture conservation practice. Information on response of newly evolved or released high yielding short duration varieties and suitable method of moisture conservation under rainfed conditions is meager. Hence, present experiment was conducted to study the response of rainfed pearlmillet varieties to moisture conservation practices and fertility levels.

Materials and Methods

An experiment was conducted during two consecutive *kharif* seasons (2013 and 2014) at Soil Conservation and Water Management Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.). The soil of the experimental field was sandy loam in texture with organic carbon 0.28%, total nitrogen 0.027%, available P_2O_5 15.0 kg ha^{-1}, available K_2O 200.9 kg ha^{-1}, pH 7.8, EC 0.36 dSm^{-1}, wilting point 6.0%, field capacity 18.3%, WHC 29.12%, bulk density 1.38 Mg m^{-3}, particle density 2.60 Mg m^{-3} and porosity 46.9%. The experiment was conducted in factorial randomized block design with 3 replications having 12 treatment combinations comprising 2 varieties, i.e. Pioneer and Kaveri supper boss, 3 fertility levels i.e. 40 : 20 : 20 kg N : P_2O_5 : K_2O ha^{-1}, 60 : 30 : 30 kg N : P_2O_5 : K_2O ha^{-1} and 80 : 40 : 40 kg N : P_2O_5 : K_2O ha^{-1} as well as 2 moisture conservation practices i.e. farmer's practice (one weeding and hoeing by *khurpi* at 20 DAS) and ridging and furrowing in between the crop rows at 20 DAS. The crop was sown on August 27 and July 27 during 2013 and 2014, respectively in rows 45 cm apart, keeping intra-row spacing of 15 cm. The crop was harvested on November 30 and 6 during 2013 and 2014, respectively. Rainfall during crop growing season was 321 and 324 mm during first and second year, respectively.

Observations on soil loss by splash were recorded by cylindrical splash cup of 10 cm diameter placed at 15 cm depth. Study on splash loss was made in one replication only where the plant stand was most uniform. Total nitrogen in grain and stover was determined colourimetrically by developing colour through Nessles's reagent as described by (1). Phosphorus was estimated colourimetrically by the chlorostannous reduced phospho-molybdenum blue method in H_2SO_4 system and potassium on Carl Zeiss model II Flame photometer by the methods described by (2).

Results and Discussion

Content and uptake of NPK : Variety 'Kaveri supper boss' gave significantly more NPK contents and uptake by grain and stover than 'Pioneer' during both the years (Table-1 and 2). This is because of difference in the genetic makeup of the varieties. Application of 80 kg N + 40 kg P_2O_5 + 40 kg K_2O ha^{-1} exhibited the highest concentration and uptake of NPK both by grain and stover during both the years. Application of 40 kg N + 20 kg P_2O_5 + 20 kg K_2O ha^{-1} treatment exhibited the lowest values during both the years. The highest values being observed

Received : October-2020 Revised : November-2020 Accepted : December-2020

Table-1 : Nutrient content in grain and stover of pearlmillet as influenced by varieties, fertility levels and moisture conservation practices.

Treatment	Nitrogen content (%)				Phosphorus content (%)				Potassium content (%)			
	Grain		Stover		Grain		Stover		Grain		Stover	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Varieties												
Pioneer	1.93	1.95	1.33	1.36	0.90	0.91	0.49	0.49	0.37	0.39	0.84	0.86
Kaveri supper boss	2.03	2.07	1.39	1.44	1.04	1.06	0.53	0.55	0.39	0.44	0.86	0.90
C.D. (P=0.05)	0.08	0.06	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.02
Fertility levels (kg/ha)												
40kg N+20 kg P_2O_5+20kg K_2O	1.88	1.89	1.31	1.33	0.90	0.92	0.47	0.46	0.36	0.37	0.84	0.82
60kg N+30 kg P_2O_5+30kg K_2O	1.97	2.00	1.37	1.41	0.98	0.98	0.51	0.53	0.38	0.42	0.85	0.89
80kg N+40 kg P_2O_5+40kg K_2O	2.09	2.14	1.42	1.46	1.03	1.05	0.55	0.57	0.39	0.45	0.86	0.93
C.D. (P=0.05)	0.09	0.08	0.04	0.04	0.05	0.04	0.03	0.03	0.01	0.02	0.01	0.03
Moisture cons. practices												
Farmer's practice	1.93	1.95	1.34	1.37	0.95	0.94	0.49	0.50	0.37	0.37	0.84	0.86
Ridging and furrowing	2.03	2.07	1.39	1.43	0.99	1.02	0.53	0.55	0.39	0.45	0.86	0.91
C.D. (P=0.05)	0.08	0.06	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.02

Table-2 : Nutrient uptake by grain and stover of pearlmillet as influenced by varieties, fertility levels and moisture conservation practices.

Treatment	Nitrogen uptake (kg/ha)				Phosphorus uptake (kg/ha)				Potassium uptake (kg/ha)			
	By grain		By stover		By grain		By stover		By grain		By stover	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Varieties												
Pioneer	29.67	27.51	64.31	57.42	13.79	12.77	23.69	20.71	5.67	5.48	40.56	36.35
Kaveri supper boss	36.82	33.17	72.93	67.49	18.51	16.91	27.81	25.80	7.06	7.02	45.13	42.22
C.D. (P=0.05)	2.94	3.10	5.10	3.42	1.61	1.52	2.14	2.01	0.86	0.82	2.94	2.81
Fertility levels (kg/ha)												
40kg N+20 kg P_2O_5+20kg K_2O	27.62	26.35	58.56	55.31	13.12	12.82	21.08	19.13	5.13	5.16	37.78	34.10
60kg N+30 kg P_2O_5+30kg K_2O	33.53	30.16	70.03	63.06	16.58	14.78	26.14	23.70	6.31	6.33	43.67	39.80
80kg N+40 kg P_2O_5+40kg K_2O	38.50	34.50	77.34	69.04	18.87	16.93	30.04	26.96	7.68	7.25	47.06	43.98
C.D. (P=0.05)	3.62	3.94	6.13	4.33	1.92	1.70	2.73	2.61	1.22	1.18	3.16	3.10
Moisture cons. practices												
Farmer's practice	30.21	27.68	64.27	57.82	14.97	13.38	23.58	20.98	5.88	5.27	40.39	36.22
Ridging and furrowing	36.25	33.00	73.02	66.69	17.28	16.30	27.92	25.53	6.86	7.23	45.28	42.36
C.D. (P=0.05)	2.94	3.10	5.10	3.42	1.61	1.52	2.14	2.01	0.86	0.82	2.94	2.81

with application of 80 kg N + 40 kg P_2O_5 + 40 kg K_2O ha^{-1} in respect of NPK uptake might have been due to greatest amount of drymatter production as a result the highest grain and stover yields obtained under high fertility schedule. The increase in concentration of these nutrients on their addition have also been reported by (3, 4). Ridging and furrowing practice showed higher NPK content and uptake both by the grain and stover over farmer's practice during both the years. The findings of (5, 6) supported these results.

Splash loss : Variety 'Pioneer' showed higher splash loss of soil as compared to 'Kaveri supper boss' during both the years (Table-3). The soil loss was found to be directly governed by the crop canopy development. Since, maximum canopy was found in variety 'Kaveri supper boss'. Variety 'Pioneer' which had the lowest canopy showed maximum soil loss. Fertility levels also visualized that splash loss of soil showed declining trend with increasing fertility levels, resulting in better canopy development. These results are in conformity with the findings of (7). Higher splash loss of soil under farmer's practice (control) due to minimum vegetative canopy. The lower splash loss under ridging and furrowing practice due to maximum leaf coverage. These results are in agreement with the findings of (7).

Yield : Variety 'Kaveri supper boss' gave significantly more grain and stover yields than 'Pioneer' during both the years (Table-3). The grain yield of 'Kaveri supper boss' was higher because of more ear length, weight of ear and 1000-grain weight. These results are in agreement with the findings of (8). Similarly, application of fertilizers significantly affected the production of grain and stover yields during both the years. The highest yield was obtained with application of 80 kg N + 40 kg P_2O_5 + 40 kg

Table-3 : Splash loss, grain yield, stover yield and net return of pearlmillet as influenced by varieties, fertility levels and moisture conservation practices.

Treatment	Splash loss (t/ha)		Grain yield (q/ha)			Stover yield (q/ha)			Net return (Rs./ha)	
	2013	2014	2013	2014	Mean	2013	2014	Mean	2013	2014
Varieties										
Pioneer	4.18	4.44	17.12	15.75	16.44	57.76	50.45	54.11	13421	11304
Kaveri supper boss	4.02	4.31	20.24	17.91	19.08	62.76	56.08	59.42	16058	14523
C.D. (P=0.05)	-	-	0.56	0.85	-	1.60	1.52	-	-	-
Fertility levels (kg/ha)										
40kg N+20 kg P_2O_5+20 kg K_2O	4.24	4.52	16.41	15.58	16.00	53.75	49.72	51.74	11966	11139
60kg N+30 kg P_2O_5+30 kg K_2O	4.13	4.38	19.03	16.87	17.95	61.42	53.49	57.46	15544	12986
80kg N+40 kg P_2O_5+40 kg K_2O	3.94	4.23	20.61	18.04	19.33	65.45	56.59	61.02	16709	14615
C.D. (P=0.05)	-	-	0.68	1.04	-	1.96	1.85	-	-	-
Moisture cons. practices										
Farmer's practice	4.20	4.49	17.73	15.85	16.79	57.46	50.65	54.06	13284	11797
Ridging and furrowing	4.00	4.26	19.64	17.81	18.73	62.95	55.96	59.46	16195	14028
C.D. (P=0.05)	-	-	0.56	0.85	-	1.60	1.52	-	-	-

K_2O ha^{-1}. (9) opined similar view. Ridging and furrowing practice brought about significantly higher grain and stover yields as compared to farmer's practice during both the years. The grain and stoveryields in ridging and furrowing practice was higher because of higher growth and yield attributing characters. These results are supported by the findings of (7).

Net return : Variety 'Kaveri supper boss' gave higher net return (Rs 15291 ha^{-1}) over 'Pioneer' (Table-3). Fertilizer application of 80 kg N + 40 kg P_2O_5 + 40 kg K_2O ha^{-1} gave the maximum net return (Rs 15662 ha^{-1}), whereas 40 kg N + 20 kg P_2O_5 + 20 kg K_2O ha^{-1} plot showed the lowest (Rs 11553 ha^{-1}). Ridging and furrowing practice gave the higher net return (Rs 15112 ha^{-1}) over farmer's practice (Rs 12541 ha^{-1}).

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