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Performance of moisture conservation practices and levels of nitrogen on sorghum under rainfed ecosystem of central Uttar Pradesh

Munish Kumar, R.A. Singh and Surendra Pratap Singh

Department Soil Conservation and Water Management, C.S. Azad University of Agriculture & Technology, Kanpur-208 002

The main problem of rainfed areas is uncertainty and uneven distribution of rainfall and loss of water through runoff which leads to low and unstable productivity due to moisture stress at critical stages of crop growth. It is well known fact that about 85 per cent of annual rainfall is received during south-west monsoon season. In this period knowledge of crop growth phases and moisture availability is more essential because the deficiency of rain water at any critical growth stage may affect the plant growth and yield. Minimizing the risk factor through *in-situ* moisture conservation, adoption of suitable crops and their varieties. Conservation agronomical practices are, therefore, vital for the success of rainfed agriculture. Sorghum occupies an area of about 3.32 lakh ha in Uttar Pradesh. Out of which about 95% is rainfed, mostly grown in Bundelkhand and Central Plain Zone of Uttar Pradesh. The average productivity is 7.79 q ha^{-1} compared to national productivity level of 706 kg ha^{-1}. Ridges and furrow conserved soil moisture which improved root development, total dry matter production, stover yield and water use efficiency compared with flat beds (Patil and Sheelavantar 2000). The objective of this study is to optimize the grain yield of sorghum under rainfed situation with the use of suitable moisture conservation practices in conjunction with nitrogen.

MATERIAL AND METHODS

A field experiment was carried out for two years during the rainy seasons of 2005-06 and 2006-07 at Soil Conservation and Water Management Farm, C.S. Azad University of Agriculture and Technology, Kanpur. The soil of the experimental site was sandy loam, having pH 7.5, organic carbon 0.36%, total nitrogen 0.03 %, available phosphorus 14.2 kg/ha and available potash 145.0 kg /ha. The treatment consists of three moisture conservation practices and four levels of nitrogen. The treatment combinations are 12, which comprised 3 levels of moisture conservation practices (M) and 4 levels of nitrogen (N) with three replications in factorial RBD. The average rainfall received during crop period was 456 mm in 2005-06 and 434 mm in 2006-07. The crop was planted in rows at spacing of 45x15 cm apart alongwith the seed rate of 15 kg ha^{-1}. The half dose of nitrogen was applied at the time of sowing and remaining half dose of nitrogen top dressed at 30 days after sowing. Sorghum variety "Bundela" was sown in the last week of July and harvested at end of the November during both the experimental seasons.

RESULTS AND DISCUSSION

Effect of moisture conservation practices

The moisture conservation practices significantly influenced the plant height. The highest plant height was found in ridge and furrow while the lowest was measured under flat bed. The ridge and furrow methods of moisture conservation showed significantly higher number of functional leaves/plant in comparison to other practices. Highest grain weight/panicle (30.64 g) was recorded in ridge and furrow closely followed by in mulching (29.50 g) and the lowest was recorded under flat bed (27.03g). The maximum grains/panicle was recorded with ridge and furrow system of moisture conservation. Maximum 1000- grain weight 31.49 g was found under ridge and furrow system as compared to other moisture conservation practices.

There was significant difference in grain yield of sorghum due to different moisture conservation practices (Table 1). Sorghum 'Bundela' gave maximum yield of 15.92 q ha^{-1} under ridge and furrow followed by 15.03 q ha^{-1} flat sowing with mulching and lowest in flat bed (12.00 q ha^{-1}). These results confirm with the findings of Patil and Sheelavantar (2000) and Patil *et al.* (2004).

Effect of nitrogen levels

The lowest plant height in respect to nitrogen levels was found under control and highest was recorded at 90 kg N ha^{-1}.

Table 1. *Effect of moisture conservation practices and N levels on growth, yield contributing characters and grain yield of sorghum (Pooled data)*

Moisture conversion practices	Growth characters		Yield traits			Grain yield (q ha^{-1})
	Plant height (cm)	Functional leaves/ plant	Grain weight/ panicle (g)	Grains/ panicle (g)	1000-grain weight (g)	
Flat sowing	151.1	8.7	27.03	1035.76	28.26	12.00
Flat sowing + organic residue mulch (21 DAS)	156.4	9.5	29.50	1119.37	30.19	15.03
Ridge and furrow	161.0	10.2	30.64	1164.84	31.49	15.92
SE(diff.)	2.6	0.33	0.66	24.12	0.40	0.43
CD at 5%	5.6	0.68	1.37	50.03	0.84	0.89
N 0	149.0	8.6	26.18	993.05	29.09	10.83
N 30	153.9	9.1	28.06	1066.53	29.63	12.74
N 60	159.0	9.7	30.24	1160.23	30.31	15.86
N 90	162.9	10.3	31.74	1206.01	30.89	17.83
SE(diff.)	3.11	0.38	0.76	27.85	0.46	0.49
CD at 5%	6.45	0.79	1.58	57.77	0.97	1.03

The number of functional leaves/plant was significantly higher at 90 kg N ha^{-1} then other N doses. Grain weight per panicle was influenced due to different nitrogen levels. The maximum grain weight /panicle (31.74 g) was recorded with 90 kg N ha^{-1} while the minimum (26.18 g) noted in control. Likewise, maximum grains/panicle was counted at 90 kg N ha^{-1} and the lowest was recorded with control. The highest 1000-grain weight was recorded with 90 kg N ha^{-1} and lowest was noted in control (Table 1).

Application of nitrogen increased the grain yield significantly, with increase in level of nitrogen over control. The maximum grain yield of 17.83 q ha^{-1} was recorded with 90 kg N ha^{-1} while the lowest in control. These findings are in agreement with those of Devasenpathy and Subrarayalu (1985). It is therefore concluded that ridge and furrow method along with 90 kg ha^{-1} nitrogen application produced highest grain yield in this region.

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