Annals of Arid Zone 46(1): 91-93, 2007

Short Communication

Effect of *in situ* Moisture Conservation on Productivity of Pearl Millet in Arid Regions of Rajasthan under Farmer's Conditions

Makkhan Lal, K.K. Bora, Ramesh Verma and P.C. Yadav
Agricultural Research Station, Rajasthan Agricultural University, Mandor, Jodhpur 342 304, India

Pearl millet, an important staple food and feed in the arid region, accounts for 22% in total coarse grains production (CMIE, 1997). However, the productivity of pearl millet is very low due to scanty and erratic distribution of rainfall, prolonged dry spell and poor inherent soil fertility in arid region. Under such conditions *in situ* moisture conservation technique has a significant role in plant establishment and improving productivity of crops (Ugale *et al.*, 1986). Moisture conservation practices are reported conserve moisture in soil profile and reduce the runoff (Patil *et al.*, 1994). Among the *in situ* moisture conservation practices ridge-furrow method was found to be highly effective in improving growth and yield of crops (Sakthivel *et al.*, 2002; Tumbare and Bhoite 2003). Hence the present study was carried out at farmers field to know the effect of *in situ* moisture conservation practices on productivity of pearl millet in arid regions of Rajasthan.

The field experiment was conducted on farmer's fields of Jodhpur and Barmer district during kharif, 2000 to 2003 on loamy sand soil. The soil contained 0.22 to 0.35% organic carbon, 10.24 to 14.32 kg available P_2O_5, and 211.3 to 265.2 kg available K_2O ha^{-1}, with pH 8.2. Total rainfall during crop season was 278.2, 521.6 and 342.6 mm during the years 2000, 2001 and 2003, respectively in Jodhpur district, and 196.6, 421.0, 389.6 and 293.6 mm during 2000, 2001, 2002 and 2003, respectively, in Barmer district. In Jodhpur district during 2002 trials were not conducted due to monsoon failure. An early maturing hybrid of pearl millet with medium height (ICMH-356) was planted with the onset of monsoon in July. The experiment was laid out in RBD on 15-selected farmer's field keeping each farmer as a replicate in both districts under rainfed condition. The crop was harvested in the last week of September, thus it matured in 78-83 days. The details of moisture conservation treatment are as under:

- Ridge-furrow after interculture (30 DAS) in wider row spacing (60 cm) with recommended N through fertilizer (40 kg N ha^{-1})
- Ridge-furrow after interculture (30 DAS) in wider row spacing (60 cm) with 50% of recommended N through fertilizer + 50% through organic manure
- Farmers practice (crop row spaced at 30 cm with 10 kg ha^{-1} N application as top dressed at the time of rainfall).

Table 1. Impact of in situ moisture conservation on grain and fodder yield of pearl millet (kg ha^{-1}) (Pool of 2000-2003)

Treatments	Grain yield		Fodder yield	
	Jodhpur (40)	Barmer (40)	Jodhpur (28)	Barmer (40)
Ridge-furrow	1028	786	1589	1376
Ridge-furrow + FYM	1130	810	1704	1464
Farmers practice	756	528	1214	1030
CD at 5%	106	68	223	153

Figures in parenthesis are numbers of experiment conducted successfully on farmer's field.

Observations on stomatal conductance (LC) transpiration rate (TR) and leaf temperature (TL) were recorded using Steady State Porometer (LI-1600, LICOR- USA) in the leaves at 12.00 h in triplicate at grain formation stage. The porometer was nulled ambient humidity, which did not vary more than 2% during observation time. Stomatal conductance (LC mmoles m^{-2} s^{-1}) and transpiration rate (TR mmoles m^{-2} s^{-1}) were calculated by summing of both the surfaces of the leaves. Relative water content (RWC) of leaves was measured by the method described earlier (Bora *et al.*, 1990).

In situ moisture conservation techniques significantly influenced the grain and fodder yield and yield attributes of pearl millet. Pooled data show that planting of pearl millet at 60 cm making ridge-furrow after interculture (30 DAS) in wider row spacing (60 cm) with 50% N through FYM and 50% N through fertilizer recorded significantly higher 49.47 and 53.41% grain and 40.36 and 43.14% fodder yield, respectively, in Jodhpur and Barmer districts over farmers practice (planting at 30 cm). However, this treatment was at par with planting of pearl millet at 60 cm making ridge-furrow after interculture (30 DAS) in wider row spacing (60 cm) with 100% N through fertilizer (Table 1). Similar trends of results were observed for yield attributes i.e., effective tillers per plant, plant height, ear length and test weight (Table 2). The enhanced yield under referred technique may be attributed to increase in aeration and conserving of available moisture in soil profile. Similarly Wani *et al.* (1997), Tumbare and Bhoite (2003), also reported

Table 2. Impact of in situ moisture conservation on plant height, effective tillers per meter row, ear head length and test weight of pearl millet (Pool of 2000-2003)

Treatments	Plant height at harvest (cm)		Effective tillers/m		Ear head length (cm)		Test weight (g)	
	Jodhpur	Barmer	Jodhpur	Barmer	Jodhpur	Barmer	Jodhpur	Barmer
Ridge-furrow	166	138	9.1	9.1	18.1	17.8	7.96	7.93
Ridge-furrow + FYM	163	137	9.2	9.5	20.7	18.3	8.24	8.22
Farmers practice	148	121	7.7	7.6	16.3	12.5	7.84	7.72
CD at 5%	4.9	9.5	0.7	1.2	1.3	1.3	0.31	0.27

Table 3. Average impact of in situ moisture conservation on water relation parameter (Pool of 2000-2003)

Treatments	RWC (%) in pearl millet leaves at grain formation stage			Stomatal conductance	Transpiration rate	Mean leaf temp. (°C)
	8 am	12 noon	4 pm		12 noon	
Ridge-furrow	76	44	65	284	11.93	35.71
Ridge-furrow + FYM	82	49	78	307	12.79	35.46
Farmers practice	74	43	58	208	8.59	35.47
CD at 5%				93	4.05	0.27

Stomatal conductance = (mmole m^{-2} s^{-1}); Transpiration rate = (mmole m^{-2} s^{-1}).

enhanced yield in crops grown under moisture conservation technique.

Plants maintained higher RWC throughout the day at grain formation stage when used ridges-furrow after intercultural 30 DAS and 50% N was applied through FYM (organic manure) (Table 3) and consequently resulted in higher yield in pearl millet compared to farmer's practices. Further, the plants maintained higher stomatal conductance and transpiration rate indicating that moisture conservation enables plants to photosynthesize more by keeping stomata open for longer duration under terminal stress condition (Table 3). Later observations indicated that the plants grown under such water conservation technique did not show moisture stress condition in plants, whereas plants grown under farmer's practice did experience water stress. Thus, it is inferred that ridges-furrow and FYM enables plants to maintain higher water status and facilitating plants to photosynthesize more resulting in enhanced yield even under terminal stress condition. Similar observation was also reported by Bora and Mathur (1998).

References

Bora, K.K., Mathur, Sudha and Bohra, S.P. 1990. Uniconazol as an antitranspirant in *Pisum sativum* L. *Oikoassay* 7: 19-20.

Bora K.K. and Mathur, Sudha 1998. Some plant growth regulators as anti transpiration in soya bean. *Annals of Plant Physiology* 12: 175-177

CMIE 1977. *Directory of Indian Agriculture,* pp. 106-107 and 110.

Patil, S.N., Khakare, M.S. and Raut, R.S. 1994. Effect of *in situ* moisture conservation measures on yield, water consumption, evapotranspiration and water use efficiency of grain sorghum under rainfed condition. *Punjab Krishi Vishawavidhalay Research Journal* 18: 170-172.

Sakthivel, N., Balasubramanian, A., Jayanthi, C., Chinnusamy, C. and Sankaran, N. 2002. Effect of *in situ* moisture conservation practice and intercropping system on yield of rainfed maize (*Zea mays*) in western zone of Tamil Nadu. *2nd International Agronomy Congress*, pp. 1280-1281.

Tumbare, A.D. and Bhoite, S.U. 2003. Effect of moisture conservation techniques on growth and yield of pearl millet-gram sequence in watershed. *Indian Journal of Dryland Agricultural Research and Development* 15: 149-155.

Ugale, S.D., Wani, A.G., Khade, P.D., Shimpi, P.J. and Patil, P.D. 1986. *In situ* conservation of soil moisture through ridges and furrow. *Millet Newsletter* 5: 10

Wani, A.G., Tumbare, A.D., Bhale, T.M. and Shinde, S.H. 1997. Response of pearl millet to N and moisture conservation practices under rain fed conditions. *Indian Journal of Dryland Agricultural Research and Development* 12: 130-132