

Influence of Integrated Nutrient Management on Weed Emergence and Productivity in Pearl Millet (*Pennisetum glaucum*)-Wheat (*Triticum aestivum*) Cropping System

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ABSTRACT

Field investigations conducted at CCS Haryana Agricultural University, Hisar, India during 2007-08 and 2008-09 revealed that both the doses and sources of nutrients increased weed emergence in pearl millet-wheat cropping system. The increase in fertilizer dose decreased weed emergence and manures as source of nutrients increased weed emergence during both the crops. The increase in fertilizer dose increased pearl millet, wheat and wheat equivalent yield and highest yield was recorded with the application of 50% recommended NPK dose through fertilizers+50% N through farm yard manure in **kharif** and 100% recommended NPK dose through fertilizers in **rabi** season during both the years and it was closely followed by the treatment where recommended dose during both the years was applied through chemical fertilizers. Among the organic sources, the increase in yield was highest with farm yard manure (FYM) and it was followed by green manure and wheat straw in descending order of magnitude.

Key words : Integrated nutrient management, fertilizers, manures, weed emergence, wheat equivalent yield

INTRODUCTION

Pearl millet-wheat is one of the most popular cropping systems under limited irrigation facility in semi-arid regions of Haryana. The crop productivity of this system is adversely affected by weeds. The wide row spacing between rows in pearl millet provides ample opportunities for weed infestation (Singh and Yadav, 1990). Wheat is also infested with several grassy and broadleaf weeds during the crop growing season (Khokhar and Nepalia, 2010). The application of nutrients from different sources as well as their doses might influence the weed flora and their emergence in both the crops. Although information is available on the influence of integrated nutrient management (INM) on yield but the information on the influence of INM on weed emergence in pearl millet-wheat cropping system is lacking. It was, therefore, considered worthwhile to study the influence of INM on the germination of weeds and crop yield in pearl millet-wheat cropping system.

MATERIALS AND METHODS

Field experiments were conducted to study the influence of INM on weed emergence and crop productivity in pearl millet-wheat cropping system at

the Research Farm of Department of Agronomy, CCS Haryana Agricultural University, Hisar, India during 2007-08 and 2008-09. The soil of the experimental plot was slightly alkaline (pH 7.8), low in available nitrogen (167.6 kg/ha), medium in available phosphorus (16.7 kg/ha), rich in available potash (291.1 kg/ha) and sandy loam in texture. The field was irrigated with canal water before seeding and fertilized as per treatment. Pearl millet (*Pennisetum glaucum* cv. HHB 197) and wheat (*Triticum aestivum* cv. PBW 343) were grown during **kharif** (rainy season) and **rabi** (winter season), respectively. Pearl millet was sown at 30 cm row spacing using 5 kg seed/ha on 5th July 2007 and 27th June, 2008 and wheat was sown at 20 cm row spacing using 100 kg seed/ha on 8th November 2007 and 4th November 2008 during 1st and 2nd year, respectively. The harvesting of pearl millet and wheat during 1st and 2nd crop season was done on 19th September, 2007 and 6th September, 2008 and 12th April, 2008 and 9th April, 2009, respectively. The experiment was laid out in a randomized block design with four replications. There were 12 treatments comprising different combinations of INM applied in **kharif** and **rabi** seasons (Table 1). The weed frequency was recorded 32 days after crop sowing (DAS) in both pearl millet and wheat with a quadrat of 50 x 50 cm from four randomly selected points in each plot. The

Table 1. Detail of treatments for **kharif** and **rabi** seasons during the two years (2007-09)

Treatments	Kharif (Pearl millet)	Rabi (Wheat)
T ₁ -Control (no fertilizer)		Control (no fertilizer)
T ₂ -50% recommended NPK dose through fertilizers		50% recommended NPK dose through fertilizers
T ₃ -50% recommended NPK dose through fertilizers		100% recommended NPK dose through fertilizers
T ₄ -75% recommended NPK dose through fertilizers		75% recommended NPK dose through fertilizers
T ₅ -100% recommended NPK dose through fertilizers		100% recommended NPK dose through fertilizers
T ₆ -50% recommended NPK dose through fertilizers+50% N through farm yard manure		100% recommended NPK dose through fertilizers
T ₇ -75% recommended NPK dose through fertilizers+25% N through farm yard manure		75% recommended NPK dose through fertilizers
T ₈ -50% recommended NPK dose through fertilizers+50% N through wheat straw		100% recommended NPK dose through fertilizers
T ₉ -75% recommended NPK dose through fertilizers+25% N through wheat straw		75% recommended NPK dose through fertilizers
T ₁₀ -50% recommended NPK dose through fertilizers+50% N through green manure		100% recommended NPK dose through fertilizers
T ₁₁ -75% recommended NPK dose through fertilizers+25% N through green manure		75% recommended NPK dose through fertilizers
T ₁₂ -Farmers' practice		Farmers' practice

weeds were controlled in the field after their count. The weather conditions which prevailed during the growing seasons were normal for the region.

RESULTS AND DISCUSSION

Weed Emergence

The predominant weeds of the experimental field during both the seasons in pearl millet were *Trianthema portulacastrum*, *Cyperus rotundus* and *Digera arvensis* and in wheat were *Phalaris minor* and *Chenopodium album*. The weed emergence was significantly influenced both by the source and dose of fertilizer application (Tables 2 and 3). The weed count of all the weeds was

highest in control, where no fertilizer was applied in both pearl millet and wheat during both the years and the weed frequency decreased with the increase in fertilizer dose from control to 50%, 50 to 75% and 75 to 100%. The weed emergence might have been decreased with the increase in fertilizer dose due to initial vigorous crop growth in these treatments. At the same level of fertilizer dose, there were more weeds in the treatments where nutrients were supplied through organic sources as compared to the treatments where nutrients were supplied through chemical fertilizers. Among organic sources, maximum weeds in both the crops were found in FYM treated plots followed by wheat straw and green manure. The application of organic manures mainly FYM to the crops might have resulted in higher

Table 2. Effect of INM treatments on weed emergence 32 DAS in pearl millet during 2007 and 2008

Treatments	Weed population/m ²									
	<i>Trianthema</i>		<i>Cyperus</i>		<i>Echinochloa</i>		Others		Total	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
T ₁	7.85* (78)	7.24 (52)	4.95 (24)	4.18 (17)	5.52 (30)	6.12 (37)	4.74 (22)	4.06 (16)	12.43 (154)	11.07 (122)
T ₂	6.65 (66)	6.67 (44)	4.52 (20)	3.81 (14)	5.34 (28)	5.70 (32)	4.53 (20)	3.81 (14)	11.60 (134)	10.22 (104)
T ₃	6.45 (64)	6.52 (42)	4.31 (18)	3.94 (15)	5.24 (27)	5.79 (33)	4.62 (21)	3.81 (14)	11.42 (130)	10.22 (104)
T ₄	5.85 (58)	6.20 (38)	4.31 (18)	3.53 (12)	5.24 (27)	5.43 (29)	4.41 (19)	3.67 (13)	11.07 (122)	9.62 (92)
T ₅	5.25 (52)	5.87 (34)	4.06 (16)	3.39 (11)	5.15 (26)	5.24 (27)	4.31 (18)	3.53 (12)	10.61 (112)	9.19 (84)
T ₆	6.95 (69)	6.59 (43)	4.74 (22)	3.94 (15)	5.61 (31)	5.61 (31)	4.62 (21)	3.81 (14)	11.98 (143)	10.17 (103)
T ₇	6.35 (63)	6.36 (40)	4.41 (19)	3.67 (13)	5.34 (28)	5.43 (29)	4.41 (19)	3.53 (12)	11.38 (129)	9.72 (94)
T ₈	6.45 (64)	6.44 (41)	4.53 (20)	3.67 (13)	5.43 (29)	5.43 (29)	4.53 (20)	3.67 (13)	11.55 (133)	9.82 (96)
T ₉	5.95 (59)	6.20 (38)	4.06 (16)	3.53 (12)	5.15 (26)	5.34 (28)	4.41 (19)	3.53 (12)	10.98 (120)	9.51 (90)
T ₁₀	6.05 (60)	6.28 (39)	4.31 (18)	3.39 (11)	5.24 (27)	5.24 (27)	4.62 (21)	3.53 (12)	11.25 (126)	9.46 (89)
T ₁₁	7.52 (56)	6.12 (37)	4.06 (16)	3.39 (11)	5.05 (25)	5.05 (25)	4.31 (18)	3.53 (12)	10.75 (115)	9.25 (85)
T ₁₂	7.45 (55)	6.20 (38)	4.41 (19)	3.67 (13)	5.34 (28)	5.43 (29)	4.53 (20)	3.94 (15)	11.07 (122)	9.77 (95)
LSD (P=0.05)	1.06	0.98	NS	NS	NS	NS	NS	NS	1.22	1.08

*Weed counts transformed to $\sqrt{X + 1/2}$. Actual values are given in parentheses. NS-Not Significant. Treatment details are given in Table 1.

Table 3. Effect of INM treatments on weed emergence 32 DAS in wheat during 2007-08 and 2008-09

Treatments	Weed population/m ²							
	<i>Phalaris</i>		<i>Chenopodium</i>		Others		Total	
	2007	2008	2007	2008	2007	2008	2007	2008
T ₁	6.67* (44)	7.90 (62)	11.33 (128)	12.35 (152)	4.30 (18)	5.24 (27)	13.80 (190)	15.54 (241)
T ₂	6.20 (38)	7.24 (52)	9.51 (90)	10.88 (118)	4.18 (17)	5.15 (26)	12.06 (145)	14.02 (196)
T ₃	5.87 (34)	6.82 (46)	8.51 (72)	10.12 (102)	3.93 (15)	4.06 (16)	11.02 (121)	12.82 (164)
T ₄	6.04 (36)	6.96 (48)	9.08 (82)	10.51 (110)	3.81 (16)	4.30 (18)	11.60 (134)	13.28 (176)
T ₅	5.70 (32)	6.67 (44)	8.28 (68)	9.82 (96)	4.18 (17)	3.81 (14)	10.79 (116)	12.43 (154)
T ₆	6.96 (48)	8.51 (72)	10.32 (106)	12.82 (164)	5.70 (32)	4.41 (19)	13.66 (186)	15.98 (255)
T ₇	6.74 (45)	8.15 (66)	9.62 (92)	12.27 (150)	5.15 (26)	4.30 (18)	12.79 (163)	15.31 (234)
T ₈	6.60 (43)	8.15 (66)	8.92 (79)	12.59 (158)	5.15 (26)	4.30 (18)	12.19 (148)	15.57 (242)
T ₉	6.67 (44)	7.78 (60)	8.63 (74)	12.35 (152)	4.74 (22)	4.18 (17)	11.85 (140)	15.15 (229)
T ₁₀	5.87 (34)	8.40 (70)	8.63 (74)	11.07 (122)	4.53 (20)	4.41 (19)	11.33 (128)	14.54 (211)
T ₁₁	5.70 (32)	7.90 (62)	8.40 (70)	10.42 (108)	4.30 (18)	4.53 (20)	10.98 (120)	13.80 (190)
T ₁₂	6.04 (36)	7.78 (60)	9.30 (86)	10.79 (116)	4.64 (21)	4.18 (17)	11.98 (143)	13.91 (193)
LSD (P=0.05)	1.06	0.95	1.02	1.16	NS	NS	1.38	1.26

*Weed counts transformed to $\sqrt{X + 1/2}$. Actual values are given in parentheses. NS–Not Significant. Treatment details are given in Table 1.

weed frequency as the organic manures might have brought weed seeds with them and/or made soil conditions favourable for weed emergence.

Yield

Highest grain yield of pearl millet and wheat during both the years was recorded with the application of 50% recommended NPK dose through fertilizers+50% N through farm yard manure in **kharif**

and 100% recommended NPK dose through fertilizers in **rabi** season (T₆) and was closely followed by the treatment where recommended dose of fertilizers was applied to both the crops (T₅) (Table 4). The pearl millet yield in 2007 and 2008 was 3214 and 3952 kg/ha in T₆ and 3036 and 3778 kg/ha in T₅ treatment, respectively. Similar values for wheat in 2007-08 and 2008-09 were 5920, 6094, 5792 and 5908 kg/ha, respectively. The mean pearl millet yield with 50, 75 and 100% recommended dose of fertilizers was 2376, 2815 and

Table 4. Effect of different treatments on yield (kg/ha) of pearl millet and wheat

Treatments	Pearl millet		Wheat		WEY	
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
T ₁	1089	1184	1308	1344	1961	2265
T ₂	1934	2562	3887	4077	5047	6070
T ₃	2048	2704	5315	5634	6544	7737
T ₄	2609	3022	4774	4884	6339	7234
T ₅	3036	3778	5792	5908	7614	8846
T ₆	3214	3952	5920	6094	7848	9168
T ₇	3010	3736	5164	5069	6970	7975
T ₈	2510	2948	5572	5602	7078	7895
T ₉	2718	3256	5378	4976	7009	7508
T ₁₀	2817	3544	5714	5824	7409	8580
T ₁₁	2896	3666	5502	5176	7240	8627
T ₁₂	2381	3342	5258	5366	6687	7965
LSD (P=0.05)	208	216	249	318		

WEY–Wheat equivalent yield. Treatment details are given in Table 1.

3407 kg/ha, indicating an increase of 439 and 592 kg/ha with increase in fertilizer dose from 50 to 75% and from 75 to 100%. There was significant increase in mean wheat yield also with the increase in fertilizer dose from 50 to 75% and from 75 to 100% and the absolute increases were 847 and 1021 kg/ha, respectively. The increase in fertilizer dose increased crop yield due probably by making more nutrients available to plants which in turn increased crop growth, yield attributes and yield (Kumar *et al.*, 2004; Singh *et al.*, 2008; Mishra *et al.*, 2010). Among the organic sources highest yield of pearl millet and wheat was recorded with the application of FYM followed by green manure and wheat straw. The wheat equivalent yield (WEY) is a better reflection of cropping system yield over individual crop yield and, therefore, individual crop yield was converted into wheat equivalent yield. The highest WEY of 7848 and 9168 kg/ha in 2007-08 and 2008-09, respectively, was recorded with the application of 50% recommended NPK dose through fertilizers+50% N in **kharif** and 100% recommended NPK dose through fertilizers in **rabi** season (T_6) and was closely followed by the treatment where recommended dose of fertilizers was applied to both the crops (T_5) and the values were 7614 and 8846 kg/ha in 2007-08 and 2008-09, respectively. The WEY was 1961 and 2265 kg/ha in control treatment during 2007-08 and 2008-09, respectively. The mean WEY with the application of 50, 75 and 100% recommended fertilizers during both the seasons was 5558, 6786 and 8230 kg/ha, respectively. The mean increase in WEY with 50, 75 and 100% over control was 163, 221 and 289%, respectively. The WEY with different organic sources

along with inorganic fertilizers i. e. 50% recommended fertilizers+50% N through FYM (T_6), 50% recommended fertilizers+50% N through wheat straw (T_8) and 50% recommended fertilizers+50% N through green manure (T_{10}) in **kharif** and 100% recommended fertilizers in **rabi** seasons was 7848 and 9168 kg/ha, 7078 and 7895 kg/ha and 7409 and 8580 kg/ha in 2007-08 and 2008-09, respectively.

REFERENCES

- Khokhar, A. K. and V. Nepalia. 2010. Effect of herbicides and nutrient management on weed flora, nutrient uptake and yield of wheat (*Triticum aestivum*) under irrigated conditions. *Ind. J. Weed Sci.* **42** : 14-18.
- Kumar, Pawan, R. K. Nanwal and S. K. Yadav. 2004. Yield and nutrient uptake in pearl millet-wheat cropping system as influenced by various fertilizer levels applied through organic and inorganic sources. *Haryana J. Agron.* **20** : 36-38.
- Mishra, J. S., V. P. Singh and Namrata Jain. 2010. Long term effect of tillage and weed control on weed dynamics, soil properties and yield of wheat in rice-wheat system. *Ind. J. Weed Sci.* **42** : 9-13.
- Singh, A. B., J. K. Saha and P. K. Ghosh. 2008. Effect of nutrient management practices on soybean (*Glycine max*)-chickpea (*Cicer arietinum*) cropping system for improving seed yield, quality and soil biological health under rainfed condition. *Ind. J. agric. Sci.* **78** : 485-489.
- Singh, Rajinder and S. K. Yadav. 1990. Time and method of weed control in pearl millet. *Exptl. Agric.* **26** : 319-324.