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Response of weed and tillage management practices under growth & yield attributes and yield in pearl millet (*Pennisetum glaucum*) - mustard (*Brassica juncea*) cropping system

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Abstract
The present investigation entitled "Weed and tillage management practices on growth and yield of pearl millet (*Pennisetum glaucum*) - mustard (*Brassica juncea*) cropping system" was conducted during *kharif* & *rabi* seasons of 2015-16 & 2016-17 at Research Farm, RVSKVV, College of Agriculture; Gwalior (M.P.). The experiment consisted of 15 treatment combinations comprising 5 tillage practices viz. Conventional tillage (*kharif* & *rabi*), Conventional tillage (*kharif*) & Zero tillage (*rabi*), Zero tillage (*kharif* & *rabi*), Zero tillage (*kharif*) & Zero tillage + Crop residue (*rabi*) and Zero tillage + Crop residue (*kharif* & *rabi*) as horizontal plots and 3 weed management practices viz. RD of herbicide (Atrazin @0.5 kg ai/ha PE+2,4-D@0.5 kg ai/ha EPoE) *kharif* & (IPU @0.75 kg ai/ha PE or Oxydairgly @0.25 kg ai/ha PE) *rabi* season, IWM (Atrazin@0.5 kg ai/ha PE+1 HW at 25DAS) *kharif* & (Pendimethalin@1.0 kg ai/ha +1 HW at 25 DAS) in *rabi* season and Weedy check (*kharif* and *rabi* season) as vertical plots laid out in strip plot design with three replications. All recommended practices were followed during crop growing season. The interaction of Conventional Tillage (*kharif* season) & Zero Tillage (*rabi* season) with IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* & (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *rabi* season registered significantly effective value of weed parameters, crop growth parameters, yield attributes and yield; while the minimum value was recorded under interaction of Zero Tillage (*kharif* and *rabi* season) with Weedy check (*kharif* and *rabi* season) over rest of the interactions.

Keywords: Growth parameters, Tillage practices, Weed management practices and Yield, Pearl millet-Mustard

Introduction
India has about 141 million hectare net sown area, out of this 80 million hectare (58%) is rainfed. It contributes 40% of food grains production and supports 2/3 of the livestock population. Despite considerable progress in irrigation development over the five year plans, 85% of coarse cereals, 83% of pulses, 42% of rice, 70% of oilseeds and 65% of cotton are still cultivated as rainfed (CRIDA, 2011) [4]. Pearl millet - mustard have been most important system of arid and semi-arid regions of Rajasthan, Haryana, Uttar Pradesh and Madhya Pradesh, where increasing in irrigation facilities have made it possible to grow these crops in sequence. Pearl millet is a stable diet for the vast majority of poor farmers and also forms an important fodder crop for livestock population in arid and semi-arid regions of India (Vetriventhan *et al*., 2008) [14]. Tillage creates soil environment favourable for plant growth. Soil tillage is one of the fundamental operations in agriculture because its influence on soil properties (physical, chemical and biological), environment and crop growth. Since continuous soil tillage strongly influence the soil properties, it is important to apply appropriate tillage practices that avoid the degradation of soil structure, maintain crop yield as well as ecosystem stability. Indian mustard (*Brassica juncea* L. Czernj. & Coss.) is the second largest oilseed crop in India after soybean. It is a diverse type of plants; which is grown as vegetables, spices, fodder for animal and source of oils and condiments, and take part in our agriculture economy by production (Anonymous, 2012) [2]. Indian mustard is particularly being deep rooted and is able to utilize the soil moisture and nutrients from lower layers of the soil. Therefore, they are mostly grown under rainfed condition at residual soil moisture. Weeds have a greater genetic Diversity than crops. Consequently, if a resource (light, water, Nutrients or carbon dioxide)

Changes within the environment, it is more likely that weeds response. These characteristic Makes the weed more efficient and vigorous than crops for utilization of natural resources. Tillage operation can have a major impact on the distribution of weed seeds in the soil on survival (Lutman *et al*., 2002) [10]. Tillage as a filter is constraints that influences weed species and weed seed distribution in the soil seed bank. The type of tillage implement and concomitant cultivation can significantly impact the weed seed distribution and composition in the soil surface (Jha and Kewat, 2013) [8]. Residue management and zero tillage are helpful to maintain soil moisture, increase the nutrient availability and reducing the weed population by creating physical barrier of sunlight. Conservation tillage practices (zero tillage mulching) are a viable approach to retain soil moisture and nutrients under semi-arid dryland situations (Amgain *et al*., 2013) [1]. Cropping practice (tillage) is an important management tool for tackling water induced erosion hazard, promoting in-situ water conservation and improving, stabilizing crop yields from rainfed production systems of semiarid and subtropical regions (Kurothe *et al*., 2014) [9].

Materials and Methods

The experiment was conducted at the Research Farm, RVSKVV, College of Agriculture; Gwalior (M.P.) during *kharif* & *rabi* seasons of 2015-16 & 2016-17 under the edaphic and climatic conditions of Gwalior (26°13' North latitude and 78°14' East longitude with an altitude of about 206 m above mean sea level). The topography of the field was almost uniform with the very slight slope from East to West direction along with good drainage. The experiment consisted of 15 treatment combinations comprising 5 tillage practices viz. Conventional tillage (*kharif* & *rabi*), Conventional tillage (*kharif*) & Zero tillage (*rabi*), Zero tillage (*kharif* & *rabi*), Zero tillage (*kharif*) & Zero tillage + Crop residue (*rabi*) and Zero tillage + Crop residue (*kharif* & *rabi*) as horizontal plots and 3 weed management practices viz. RD of herbicide (Atrazin @0.5 kg ai/ha PE+2,4-D@0.5 kg ai/ha EPoE) *kharif* & (IPU @0.75 kg ai/ha PE or Oxydairgly @0.25 kg ai/ha PE) *rabi* season, IWM (Atrazin@0.5 kg ai/ha PE+1 HW at 25DAS) *kharif* & (Pendimethalin@1.0 kg ai/ha +1 HW at 25 DAS) in *rabi* season and Weedy check (*kharif* and *rabi* season) as vertical plots laid out in strip plot design with three replications. Size of each net plot was 6.0 m x 5.2 m. The soil of experimental field was sandy clay loam with pH 7.50 and EC 0.40 dS/m. For ensuring good germination, healthy and good quality seeds were used with 6 kg/ha. The nutrients were applied @80 kg N/ha, 40 kg P_2O_5/ha and 20 kg K_2O/ha. Urea (46% N), di-ammonium phosphate (18% N & 46% P_2O_5) and muriate of potash (60% K_2O) were used as a source of nitrogen, phosphorus and potash; respectively. Half of the nitrogen was applied at sowing time as basal dose along with the full quantities of phosphorus and potash. The remaining half of nitrogen was applied at 30 DAS. All recommended practices were followed during crop growing season.

Results and Discussion

The results are describes on the basis of two years pooled data (Table 1 & 2).

Table 1: Effect of tillage practices and weed management practices on weed parameters, growth & yield attributing parameters and yield of Pearl Millet (*Pennisetum glaucum*)

Treatment	Total weed dry weight (g/m^2)	Weed Control Efficiency (%)	Plant height (cm)	Length of Ear head (cm)	No. of productive tillers/plant	Test weight (g)	Grain yield (kg/ha)	Harvest index (%)	Weed index (%)
Tillage practices									
T_1	64.22	61.10	144.08	21.46	1.15	9.46	2175	34.53	27.25
T_2	62.01	62.44	145.00	21.61	1.20	9.52	2305	34.70	22.65
T_3	97.59	40.88	135.52	20.06	0.89	8.94	1492	32.80	49.93
T_4	93.15	43.59	137.37	20.37	0.93	9.06	1600	33.12	46.46
T_5	85.54	48.17	139.04	20.67	1.00	9.17	1781	33.49	40.35
SE(m) ±	0.25	0.39	0.09	0.04	0.04	0.01	46	0.17	3.12
CD (P=0.05)	0.74	1.16	0.28	0.12	0.11	0.03	135	NS	9.19
Weed management practices									
W_1	50.51	69.39	143.62	21.42	1.13	9.45	2103	34.41	29.55
W_2	36.77	77.73	146.83	21.91	1.20	9.63	2321	34.99	22.32
W_3	154.23	6.59	130.14	19.17	0.77	8.61	1188	31.78	60.12
SE(m) ±	0.02	0.03	0.07	0.03	0.02	0.01	41	0.11	1.34
CD (P=0.05)	0.06	0.08	0.21	0.08	0.07	0.03	128	0.36	4.21

Table 2: Effect of tillage practices and weed management practices on weed parameters, growth & yield attributing parameters and yield of Mustard (*Brassica juncea*)

Treatment	Total weed dry weight (g/m^2)	Weed Control Efficiency (%)	Plant height (cm)	Number of leaves/plant	Dry matter/ plant (g)	Length of Siliqua (cm)	Test weight (g)	Grain yield (kg/ha)	Harvest index (%)	Weed index (%)
Tillage practices										
T_1	37.82	60.98	145.28	22.08	14.40	4.54	3.56	1132	27.03	16.01
T_2	36.51	62.33	146.19	22.22	14.77	4.58	3.58	1156	27.24	14.30
T_3	57.46	40.72	136.57	20.76	11.87	4.25	3.34	929	25.87	31.09
T_4	54.74	43.52	138.41	21.04	12.64	4.31	3.38	971	26.30	27.97
T_5	50.35	48.05	140.13	21.30	13.16	4.38	3.43	1012	26.51	24.92
SE(m) ±	0.10	0.41	0.11	0.02	0.09	0.01	0.007	4	0.005	1.73
CD (P=0.05)	0.31	1.20	0.32	0.05	0.26	0.03	0.020	11	0.015	5.10
Weed management practices										
W_1	29.84	69.22	144.74	22.00	14.12	4.54	3.54	1112	26.92	17.58
W_2	21.77	77.53	148.02	22.50	15.04	4.64	3.62	1190	27.32	11.72
W_3	90.51	6.61	131.18	19.94	10.95	4.06	3.21	819	25.54	39.27
SE(m) ±	0.03	0.04	0.07	0.01	0.01	0.01	0.005	4	0.004	0.18
CD (P=0.05)	0.10	0.13	0.21	0.03	0.03	0.02	0.014	13	0.013	0.55

Response observed in Pearl Millet:

- **Tillage Practices (T)**

The Conventional Tillage (*kharif* season) and Zero Tillage (*rabi* season) significantly reduced value of total weed dry weight in comparison to rest of the treatments followed by Conventional Tillage (*kharif* and *rabi* season).

The Conventional Tillage (*kharif* season) and Zero Tillage (*Rabi* season) registered significantly effective values (22.65%) of WI in comparison to rest of the treatments followed by (7.65%) Conventional Tillage (*kharif* and *Rabi* season); while losable value (49.93%) was noticed under Zero Tillage *(kharif* and *Rabi* season).

Significant reduction of weed parameters at different stages due to Conventional Tillage (*kharif* season) and Zero Tillage (*Rabi* season) was due to loosening of the soil more effectively than zero tillage practice, which might have facilitated percolation and storage of water in the root zone. The possible explanation for this could be that at early stage of the crop, the growth of weeds and crop as well was not vigorous therefore they do not had shading effect on weeds, whereas at later stages of crop growth; high crop cover deprived the weeds to photo synthetically active radiation. Results of present investigation are in close conformity with the findings of Amgain *et al.* (2013) [1], Choudhary *et al*. (2016) [3] and Verma *et al*. (2017) [13].

The Conventional Tillage (*kharif* season) and Zero Tillage (*rabi* season) recorded significantly higher value of growth parameters viz. plant height (cm) in comparison to rest of the treatments followed by Conventional Tillage (*kharif* and *rabi* season); while lowest value was registered under Zero Tillage *(kharif* and *rabi* season).

The Conventional Tillage (*kharif* season) and Zero Tillage (*rabi* season) recorded significantly higher value of yield attributes viz. length of ear head, number of productive tillers/plant and test weight (21.61 cm, 1.20 and 9.52 g; respectively) followed by (21.46 cm, 1.15 and 9.46 g; respectively) Conventional Tillage (*kharif* and *rabi* season) in comparable to rest of the treatments; while lowest value (20.06 cm, 0.89 and 8.94 g; respectively) was noticed under Zero Tillage *(kharif* and *rabi* season).

The Conventional Tillage (*kharif* season) and Zero Tillage (*Rabi* season) recorded significantly maximum value of computed parameters viz. grain yield (2305 kg/ha) followed by (2175 kg/ha) Conventional Tillage (*kharif* and *Rabi* season) in comparable to rest of the treatments; while lowest value (1492 kg/ha) was noticed under Zero Tillage *(kharif* and *Rabi* season).

This may be explained due to the fact that better tilled soil done efficient use of all available natural resources and effective absorption and utilization of nutrients and moisture resulted leading to higher photosynthetic rate and finally more accumulation of dry matter by the plants; this resulted heaviest grains. Our results confirm with the findings of Amgain *et al.* (2013) [1], Choudhary *et al*. (2016) [3] and Verma *et al*. (2017) [13].

- **Weed management practices (W)**

The total dry weight was significantly higher under Weedy check (*kharif* and *Rabi* season); while lowest was recorded under IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *Rabi* season.

The significantly inferior value (60.12%) of WI was noted under Weedy check (*kharif* and *Rabi* season); while superior (22.32%) was recorded under IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *Rabi* season.

The superiority of IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *rabi* season over rest of the weed management practices may be due to their broad-spectrum effect by combination of chemical and mechanical measures; which enhance weed management ability over rest of the treatments. The results are in conformity with the findings of Reddi Ramu (2015) [11], Guggari and Mallappa (2017) [5] and Singh *et al*. (2017) [12].

The growth parameters viz. plant height (cm) was recorded significantly maximum under IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *Rabi* season; while lowest was recorded under Weedy check (*kharif* and *Rabi* season).

IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *rabi* season registered significantly higher value of yield attributes viz. length of ear head, number of productive tillers/plant and test weight (21.91 cm, 1.20 and 9.63 g; respectively); while lowest value (19.22 cm, 0.77 and 8.61 g; respectively) was observed under Weedy check (*kharif* and *rabi* season).

IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *rabi* season registered significantly higher value of computed parameters viz. grain yield and HI (2321 kg/ha and 34.99%; respectively); while lowest value (1188 kg/ha and 31.78%; respectively) was observed under Weedy check (*kharif* and *rabi* season).

Due to favourable conditions created by weed management practices; which resulted higher accumulation of crop dry matter and optimum translocation of food materials to the pod as well as effective uptake of nutrients and moisture. This might be due to effective control of weeds and thus resulted in lower accumulation of dry matter in weeds and lower crop-weed competition associated with effective availability of moisture and nutrients. These results are in line with the work of Guggari and Mallappa (2017) [5] and Singh *et al*. (2017) [12].

Response observed in Mustard

- **Tillage Practices (T)**

The Conventional Tillage (*kharif* season) and Zero Tillage (*Rabi* season) significantly reduced value of total weed dry weight in comparison to rest of the treatments followed by Conventional Tillage (*kharif* and *Rabi* season).

The Conventional Tillage (*kharif* season) and Zero Tillage (*Rabi* season) registered significantly effective values (14.30%) of WI in comparison to rest of the treatments followed by (16.01%) Conventional Tillage (*kharif* and *Rabi* season); while losable value (31.09%) was noticed under Zero Tillage *(kharif* and *Rabi* season).

The Conventional Tillage (*kharif* season) and Zero Tillage (*rabi* season) recorded significantly higher value of growth parameters viz. plant height (cm), number of leaves/plant and dry matter/plant (g) in comparison to rest of the treatments followed by Conventional Tillage (*kharif* and *rabi* season); while lowest value was registered under Zero Tillage *(kharif* and *rabi* season).

The Conventional Tillage (*kharif* season) and Zero Tillage (*rabi* season) recorded significantly higher value of yield attributes viz. length of siliqua and test weight (4.58 cm and 3.58 g; respectively) followed by (4.54 cm and 3.56 g; respectively) Conventional Tillage (*kharif* and *rabi* season) in

comparable to rest of the treatments; while lowest value (4.25 cm and 3.34 g; respectively) was noticed under Zero Tillage *(kharif* and *rabi* season).

The Conventional Tillage (*kharif* season) and Zero Tillage (*rabi* season) recorded significantly maximum value of computed parameters viz. grain yield and HI (1156 kg/ha and 27.24%; respectively) followed by (1132 kg/ha and 27.03%; respectively) Conventional Tillage (*kharif* and *rabi* season) in comparable to rest of the treatments; while lowest value (929 kg/ha and 25.92%; respectively) was noticed under Zero Tillage *(kharif* and *rabi* season).

Results of present investigation are in close conformity with the findings of Jakhar *et al*. (2018) [7].

- **Weed management practices (W)**

The total dry weight was significantly higher under Weedy check (*kharif* and *Rabi* season); while lowest was recorded under IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *Rabi* season.

The significantly inferior value (39.27%) of WI was noted under Weedy check (*kharif* and *Rabi* season); while superior (11.72%) was recorded under IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *Rabi* season.

The growth parameters viz. plant height (cm), number of leaves/plant and dry matter/plant (g) were recorded significantly maximum under IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *Rabi* season; while lowest was recorded under Weedy check (*kharif* and *Rabi* season).

IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *rabi* season registered significantly higher value of yield attributes viz. length of siliqua and test weight (4.64 cm and 3.62 g; respectively); while lowest value (4.06 cm and 3.21 g; respectively) was observed under Weedy check (*kharif* and *rabi* season).

IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *rabi* season registered significantly higher value of computed parameters viz. grain yield and HI (1190 kg/ha and 27.32%; respectively); while lowest value (819 kg/ha and 25.54%; respectively) was observed under Weedy check (*kharif* and *rabi* season).

Could be ascribed to effective weed suppression during critical period of crop weed competition which might have favoured better utilization of available resources. Similar findings have also been reported by Yadav *et al*. (2017) [15] and Gupta *et al*. (2018) [6].

Conclusion

Conventional Tillage (*kharif* season) and Zero Tillage (*rabi* season) (T_1) and IWM (Atrazin @ 0.5 kg ai/ha PE + 1 HW at 25 DAS) *kharif* and (Pendimethalin @ 1.0 kg ai/ha + 1 HW at 25 DAS) in *rabi* season (W_5) as well as their interaction noticed significantly superior values of weed parameters, growth & yield attributing parameters and yield of pearl millet – mustard cropping system over rest of the treatments.

References

1. Amgain LP, Sharma AR, Das TK, Behera UK. Effect of residue management on productivity and economics of pearl millet (*Pennisetum glaucum*)-based cropping system under zero-till condition. Indian Journal of Agronomy. 2013; 58(3):298-302.
2. Anonymous, Statistical tables, Ministry of Finance, Government of India, 2012.
3. Choudhary M, Rana KS, Rana DS, Bana RS. Tillage and crop residue effects in rainfed pearl millet (*Pennisetum glaucum*) in conjunction with sulphur fertilization under pearl millet–Indian mustard (*Brassica juncea*) cropping system. Indian Journal of Agronomy. 2016; 61(1):15-19.
4. CRIDA, Vision 2030. Central Research Institute for Dry land Agriculture, Santoshnagar, Hyderabad, India, 2011, 31.
5. Guggari AK, Mallappa R. Weed management in rainfed pearl millet through sequential application of post-emergence herbicides. The Bioscan. 2017; 12(0):1159-1162.
6. Gupta KC, Kumar S, Saxena R, Effect of different weed control practices on yield and returns of mustard (*Brassica juncea* L.). Journal of Crop and Weed. 2018; 14(1):230-233.
7. Jakhar P, Rana KS, Dass Anchal, Choudhary Anil K, Kumar P, Meena MC. *et al* Tillage and residue retention effect on crop and water productivity of Indian mustard (*Brassica juncea*) under rainfed conditions. Indian Journal of Agricultural Sciences. 2018; 88(1):47-53.
8. Jha A, Kewat ML. Weed composition and seed bank as affected by different tillage and crop establishment techniques in rice-wheat system. Indian Journal of Weed Science. 2013; 45(1):19-24.
9. Kurothe RS, Kumar G, Singh R, Singh HB, Tiwari SP, Vishwakarma AK. *et al* Effect of tillage and cropping systems on runoff, soil loss and crop yields under semiarid rainfed agriculture in India. Soil & Tillage Research. 2014; 140:126-134.
10. Lutman PJW, Cussans GW, Wright KJ, Wilions BJ, The persistence of seeds of 16 weed species over year in two arable fields. Weed Research. 2002; 42:231-241.
11. Reddi Ramu Y, Integrated weed management in pearl millet [*Pennisetum glaucum* (L) R. Br. Emend. Stuntz]. MSc Thesis. Acharya N.G. Ranga Agricultural University, Guntur, 2015, 166.
12. Singh R, Kumar R, Kumar A, Kumar S, Kumar J, Pal LK. *et al* Effect of weed management on growth, yield and yield attributes of Pearl millet (*Pennisetum glaueum* L) var. Manupur under rainfed condition. Journal of Pharmacognosy and Phytochemistry. 2017l; 6(6):1133-1135.
13. Verma JK, Pareek NK, Prajapat AL, Singh Hari, Saharan B. Bijarnia AL. *et al* Influence of tillage. practices on quality parameters of pearl millet (*Pennisetum glaucum* LR. Br.) cultivars under rainfed conditions of Rajasthan. Annals of Agri Bio Research. 2017; 22(2):192-195.
14. Vetriventhan M, Nirmalakumari A, Ganapathy S, Heterosis for grain yield components in pearl millet (*Pennisetum glaucum* LR. Br.). World Journal of Agricultural Sciences. 2008; 4:657-660.
15. Yadav KA, Kureel RS, Tej Pratap Singh, Kumar P, Mehta S, Dubey Kumar S. *et al* Effect of various herbicide molecules on weed management in Indian mustard (*Brassica juncea* L. Czern & Coss). Journal of Pharmacognosy and Phytochemistry. 2017; 6(6):2479-2482.