



## Efficacy of Pre-emergence, Post-emergence and Tank Mix Application of Herbicides for Control of Weeds in Pearl millet

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### ABSTRACT

Weed control studies in hybrid pearl millet (NPH-2475) were carried out during *kharif* seasons of 2014-15 at Agricultural Research Station, Malnoor University of Agricultural Sciences, Raichur, Karnataka. Results indicated that tank mix application of atrazine @ 0.32 kg ha<sup>-1</sup> + pendimethalin 0.5 kg ha<sup>-1</sup> followed by one hand weeding recorded significantly the highest grain yield (2123 kg ha<sup>-1</sup>). The next best treatments were pendimethalin (1.0 kg ha<sup>-1</sup>) followed by one hand weeding (1543 kg ha<sup>-1</sup>) and hand weeding twice (1525 kg ha<sup>-1</sup>). The weed intensity was lower in these treatments. Among the herbicides, atrazine was more efficient in controlling broad leaved weeds while pendimethalin controlled monocot weeds. Hence, the combination showed best performance

**Key words :** Grain yield, Herbicides, Pearl millet, Tank mix application of herbicides.

Pearl millet is an important minor grain crop grown in Karnataka. Rapid growth of large number of weed species simultaneously with in pearl millet cause severe crop- weed competition and reduction in crop yields to an extent of 35 to 90 per cent depending upon the weed flora and weed density (Umrani, 1980). Pearl millet being a short duration crop and incessant rains usually do not permit timely inter cultivation. Manual weeding is also difficult on a large scale due to high cost and also labour shortage at peak periods. Presently, atrazine is recommended as pre-emergence herbicide (Fowler, 1997) but it is at lower rates (0.65 kg ha<sup>-1</sup>) that is insufficient to control all range of weeds and that too for long time. The post-emergence herbicide 2,4-D controls only broad leaf weeds. Recent studies indicated that combi products or tank mix herbicides are more consistent in weed control than single application and helps to minimize the weed menace. Hence, present investigations was under taken to study the efficacy of pre-emergence, post-emergence and tank mix application of herbicides for control of weeds in pearl millet.

### MATERIAL AND METHODS

An experiment was conducted at Agricultural Research Station, Malnoor (UAS, Raichur) during *kharif* season of 2014-15. The experiment site is located at 77° 20' E longitude, 16° 12' N latitude and at an altitude of 389 m above

mean sea level. It comes under Agro Climatic Zone-2 of North-Eastern Dry zone of Karnataka. The soil of the experimental site was medium black clay with pH 8.1, available N- 243 kg ha<sup>-1</sup>, P<sub>2</sub>O<sub>5</sub>- 34 kg ha<sup>-1</sup> and K<sub>2</sub>O - 292 kg ha<sup>-1</sup>. There were eleven treatments viz., T<sub>1</sub>: Atrazine 50 EC (100%), T<sub>2</sub>: Pendimethalin 38.7 CS (100%), T<sub>3</sub>: Tank mix application of Atrazine (50%) + Pendimethalin (50%), T<sub>4</sub>: Atrazine 50 EC (100%) fb one hand weeding at 30-40 DAS, T<sub>5</sub>: Pendimethalin 38.7 CS (100%) fb one hand weeding at 30-40 DAS, T<sub>6</sub>: Tank mix application of Atrazine (50%) + Pendimethalin (50%) fb one hand weeding at 30-40DAS, T<sub>7</sub>: 2,4-D sodium salt 80% at 20-25 DAS, T<sub>8</sub>: Metribuzin 70WP at 20-25 DAS, T<sub>9</sub>: 2,4-D sodium salt 80% (50%) + Metribuzin (50%), T<sub>10</sub>: Hand weeding twice at 20 and 40 DAS and T<sub>11</sub>: Unweeded check were tested in randomized block design replicated thrice. The gross and net plot size was 3.6 m x 3.0 m and 2.7 m x 2.6 m, respectively.

Pearl millet genotype, NPH-2475 was drill sown on 12-08-2014 by giving a spacing of 45 cm and at 15 days after sowing, thinning was done keeping one seedling at 10 cm. A recommended fertilizer dose of 100: 62.5: 25.3 kg NPK ha<sup>-1</sup> was applied. At sowing, 50 % of N and full dose of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was applied in the form of ammonium sulphate, urea and muriate of potash. Remaining 50 per cent N was applied at 30 days

after sowing in the form of urea. The pre-emergence herbicides were sprayed one day after sowing and post-emergence spray was given 20 days after sowing. A knapsack sprayer with 12 liter capacity with fish tail nozzle was used. The spray volume was 500 l ha<sup>-1</sup>. The weed density and weed dry weight were recorded at 60 DAS by putting a quadrat of 0.25 m<sup>2</sup> at random in each plot and converted to m<sup>2</sup>. The crop was harvested on 18-11-2014. Other agronomic practices were carried out as per the recommendation.

## RESULTS AND DISCUSSION

The weed flora of the experimental site comprised of monocots, broad leaf and sedges. The important grassy weeds are *Echinochloa colonum*, *Dinebra retroflexa* and *Cynodon dactylon*. *Cyperus rotundus* was the only species under sedges. Among broad leaved weeds *Parthenium hysterophorus*, *Phyllanthus niruri*, *Euphorbia geniculata* and *Acalypha indica* were the dominant weeds.

### Effect on weeds :

At 60 days after sowing significantly higher weed count was recorded in weedy check compared to the rest of the treatments (Table 1). This may be attributed to high number of monocots, broad leaf and sedge weeds population, thus resulted in high number of total weed count. This non interruption of weed growth in weedy check resulted in maximum utilization of resources like light, moisture and nutrients and resulted in high dry weight of weeds. Among various herbicide treatments, tank mix application of atrazine @ 0.32 kg ha<sup>-1</sup> + pendimethalin (0.5 kg ha<sup>-1</sup>) followed by one hand weeding (T6) recorded the lowest total weed count (2.95 m<sup>-2</sup>) followed by hand weeding twice (T10) (4.19 m<sup>-2</sup>) and pendimethalin (1.0 kg ha<sup>-1</sup>) followed by one hand weeding (T5) (4.97 m<sup>-2</sup>). These treatments were on par with each other but significantly superior over rest of the treatments. This was as a result of lower monocots, broad leaf and sedge weeds in these treatments. The dry weight of the weeds followed similar trend.

The weed count and weed dry weight between atrazine and pendimethalin significantly differ indicating the efficiency of the herbicides. Atrazine controlled more efficiently the broad leaf

weeds (5.41m<sup>-2</sup>) compared to monocot weeds (8.46 m<sup>-2</sup>) while pendimethalin controlled monocot weeds more efficiently (6.60 m<sup>-2</sup>). Gaur *et.al.* (1991) also reported that pre-emergence application of atrazine @ 0.5 kg ha<sup>-1</sup> completely controlled broad leaf weeds, however, did not control all grassy weeds. Similarly, 2,4-D sodium salt and metribuzin or its combinations controlled broad leaved weeds and sedges more efficiently (Table 1).

### Growth, yield and its attributes:

The treatment T6 i.e tank mix application of atrazine + pendimethalin followed by one hand weeding recorded significantly the highest grain yield (2123 kg ha<sup>-1</sup>) over all the other treatments (Table 2). The increase was to the tune of 39 per cent over hand weeding. This may be attributed to higher weight per ear head (33.67g). This was as a result of more number of seeds per ear head and high weight per 1000 seeds (11.89 g). The higher panicle length (18.0 cm) and girth (3.5 cm) of pearl millet in this treatment helped in accommodating more number of bold seeds (Table 2). All these characters were supported by higher growth of the plant that reflected through plant height (124.8cm). The results corroborate the findings of Bogdan *et. al.* (2004) and Walia *et. al.* (2007).

The next best treatments were pendimethalin followed by one hand weeding (1543 kg ha<sup>-1</sup>), hand weeding twice (1525 kg ha<sup>-1</sup>), atrazine followed by one hand weeding (1432 kg ha<sup>-1</sup>) and tank mix application of atrazine + pendimethalin (1358 kg ha<sup>-1</sup>). These treatments were on par with each other but significantly superior over other treatments. These treatments were positively correlated by growth and yield attributes.

Single application of atrazine or pendimethalin controlled weeds only upto 20-25 days and further there was luxuriant growth of weeds. So, application of these herbicides alone with out hand weeding was not sufficient to get higher yields, while application of 2,4-D sodium salt and metribuzin also did not increased the yields as a result of these herbicides controlled only broad leaf weeds and there was luxuriant growth of monocot weeds, that ultimately reduced the growth, yield attributes and yield of pearl millet.

Table 1. Weed density and weed dry weight as influenced by the application of different herbicides.

	Weed density (m <sup>2</sup> )				Weed dry weight (m <sup>2</sup> )			
	Monocot	Broad leaf	Sedges	Total	Monocot	Broad leaf	Sedges	Total
Atrazine 50 EC (100%)	8.46*(70.67)	5.41(29.33)	5.71(42.67)	11.95(142.67)	9.54(92.96)	3.83(16.77)	4.38(30.49)	11.63(140.23)
Pendimethalin 38.7 CS (100%)	6.60(42.67)	6.98(48.00)	5.86(45.33)	11.63(136.00)	4.21(16.76)	6.45(40.75)	5.24(36.05)	9.63(93.56)
Atrazine (50%) + Pendimethalin (50%)- tank mix	6.18(38.67)	4.64(21.33)	2.74(8.00)	8.23(68.00)	3.34(10.32)	3.17(9.88)	4.36(24.27)	6.60(44.47)
T1- one hand weeding at 30-40DAS	8.11(65.33)	4.07(16.00)	2.69(12.00)	9.59(93.33)	5.04(29.45)	3.02(8.27)	2.58(10.67)	6.98(48.39)
T2- one hand weeding at 30-40DAS	4.10(16.00)	1.82(2.67)	2.19(6.67)	4.97(25.33)	4.08(16.56)	2.46(5.23)	2.80(13.33)	5.93(35.12)
T3- one hand weeding at 30-40DAS	2.75(6.67)	1.41(1.33)	1.00(0.00)	2.95(8.00)	2.50(5.72)	1.76(3.01)	1.00(0.00)	3.11(8.73)
2,4-D sodium salt 80% at 20-25 DAS	12.15(149.33)	1.82(2.67)	2.46(9.33)	12.64(161.33)	8.77(87.16)	1.94(3.20)	1.72(3.00)	9.21(93.36)
Metribuzin 70WP at 20-25 DAS	8.54(72.00)	1.67(2.67)	1.41(1.33)	8.77(76.00)	6.00(36.19)	1.66(2.65)	1.24(0.67)	6.30(39.51)
2,4-D sodium salt 80% (50%) + Metribuzin (50%)	8.68(74.67)	1.00(0.00)	1.00(0.00)	8.68(74.67)	6.37(42.83)	1.00(0.00)	1.00(0.00)	6.37(42.83)
Hand weeding twice at 20 and 40 DAS	3.37(10.67)	1.00(0.00)	2.54(6.67)	4.19(17.33)	3.18(9.35)	1.00(0.00)	1.96(4.33)	3.67(13.68)
Unweeded check	10.24(104.00)	6.86(46.67)	8.68(74.67)	15.04(225.33)	11.12(124.01)	7.79(59.75)	6.85(46.23)	15.18(229.99)
SEM+/-	0.40	0.48	1.37	0.73	1.08	0.58	1.4	1.12
CD 0.05	1.19	1.41	4.04	2.16	3.19	1.71	4.26	3.29

\* The data is  $\sqrt{1+x}$  transformed

Data in parenthesis is the original data

Table 2. Yield attributes and seed yield of Pearl millet as influenced by various weed control treatments.

Treatments	Dose kg ha <sup>-1</sup>	Plant height (cm)	Girth (cm)	Panicle length (cm)	1000 seed weight (g)	Weight / head (g)	Seed yield (kg ha <sup>-1</sup> )
Atrazine 50 EC (100%)	0.65	112.6	2.27	14.0	8.25	22.33	432
Pendimethalin 38.7 CS (100%)	1.00	113.3	2.47	16.5	9.20	27.67	790
Atrazine (50%) + Pendimethalin (50%)- tank mix	0.32+0.5	121.7	2.63	16.9	9.60	32.33	1358
T1- one hand weeding at 30-40DAS	0.65	120.8	2.67	17.2	11.24	31.33	1432
T2- one hand weeding at 30-40DAS	1.00	122.3	2.90	17.9	10.68	32.67	1543
T3- one hand weeding at 30-40DAS	0.32+0.5	124.8	3.50	18.0	11.89	33.67	2123
2,4-D sodium salt 80% at 20-25 DAS	2.0	103.8	2.30	14.1	7.61	22.33	407
Metribuzin 70WP at 20-25 DAS	0.525	112.4	2.40	15.8	9.59	25.67	630
2,4-D sodium salt 80% (50%) +Metribuzin (50%)	1.0+0.26	116.8	2.50	15.0	8.73	28.00	914
Hand weeding (twice- 20 and 40 DAS)	-	119.1	3.07	16.1	11.12	32.67	1525
Unweeded check	-	102.5	2.03	13.2	9.35	16.00	407
SEm+/-	-	3.05	0.104	0.8	1.14	0.784	631
CD 0.05	-	9.01	0.31	2.3	3.37	2.31	1862

**Conclusion :**

It was concluded that tank mix application of atrazine @ 0.32 kg ha<sup>-1</sup> + pendimethalin (0.5 kg ha<sup>-1</sup>) followed by one hand weeding at 30-40 days after sowing was found to be the best treatment in controlling weeds and increasing seed yield in Pearl millet.

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