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COMPARATIVE EFFICACY OF DIFFERENT HERBICIDES AGAINST BROAD LEAF WEEDS IN WHEAT

Muhammad Ashiq[1], Noor Muhammad and Noor Ahmad

ABSTRACT

Herbicides Buctril-M @ 494 g, Buctril Super @ 445g, Logran extra 64WG 250g, Shield 75WDG @ 56g ha^{-1}, Strive-M 30WP @ 148 g ha^{-1}, Lanceolate star 15EQ @ 148 g ha^{-1} and Aim 40DF @ 19.76 g a.i. ha^{-1} were tested during rabi season of 2003-2004 and 2004-2005 to investigate their comparative efficacy against annual and perennial broad leaf weeds in wheat. All the herbicides tested gave complete control of Chenopodium album and Rumex dentatus. Logran extra and Shield gave poor control of Convolvulus arvensis. Among various herbicides tested only Lanceolate star and Strive-M controlled Lathyrus aphaca and Galium aparine. As regards grain yield, Lanceolate star was found to be the best dicot weedicide. It gave 26% more grain yield than control.

Key Words: Wheat, herbicides, comparative efficacy and boadleaf weeds.

INTRODUCTION

In addition to many other factors the low yield of wheat is attributed to serious weed infestation. Losses due to weeds have been reported from 18 to 30% (Ashiq and Cheema, 2005). The total loss of wheat has been estimated 2.57 million tons annually (Shad, 1987) but recently these loses have been estimated as much as trifold of this figure and a national loss of 28 billions is attributed to weeds (Hashim and Marwat, 2001). Yield losses due to weeds have been estimated from 13-14.6% in the world; 20-21% in South Asia while 8.0-9.5% in the USA (CPC, 2002). Out of total import of herbicides worth Rs. 2.2 billion, 63% were used on wheat alone during 2004 in Pakistan. Weeds not only reduce wheat yield but also deteriorate its quality and market value. Hence, weed control is very important for increasing wheat production. Use of herbicides has proved an effective tool to achieve the goal of self-sufficiency in wheat during the previous decade. From

[1] Agronomic Research Institute, Ayub Agricultural Research Institute, Jhang Road, Faisalabad.

1979 to 2006, more than a dozen herbicide molecules as single or combined form have been tested and more than 50 formulations have been approved for weed control in wheat. Out of these, 18 formulations have been approved for the control of dicot weeds in Punjab (Anonymous, 2004). No doubt, dicot weeds don not reduce as much wheat yield as those of grassy weeds, but as a result of frequent use of isoproturon, new dicot weeds like *Lathyrus aphaca, Convolvulus arvensis and Galium aparine* are emerging. These weeds are tolerant to isoproturon and most of the prevalent dicot herbicides and are emerging as problem weeds in Punjab. *L. aphaca, C. arvensis* and *G. apraine* have become problem weeds of wheat in rice zone, in cotton zone and in the central mixed crop zone in Punjab (Haleemi, 1995). These bold seeded weeds are not separated during threshing process hence, their seed contamination is leading to wide spread dispersal along with wheat seed. Weeds cannot effectively be managed merely through physical method, which not only is labour intensive but also capital intensive too. As a matter of fact, with the rising cost of labour and power, the judicious use of herbicides for the time being, is the only acceptable way for the effective weed management in wheat (Ashiq *et al.* 2003). Unfortunately, most of the dicot weed killers do not control some of the dicot weeds effectively (Zimdahl, 1993). Most of the dicot weed killers have been approved randomly for all dicot weeds irrespective of their comparative efficacy against individual weeds. Our research indicated that different herbicides worked differently on variety of dicot weeds. This study was designed to find out the comparative efficacy of dicot weedicides so that weed specific herbicidal solutions may be recommended for practical weed control in wheat.

MATERIALS AND METHODS

An experiment was conducted during winter 2003-04 and 2004-05 in the Directorate of Agronomy, Ayub Agricultural Research Institute, Faisalabad. The trial was laid out in randomized complete block design, having three replications and a plot size of 8 x 2m^2 with a row spacing of 25 cm apart comprising eight rows, 8 m long. Crop was sown during early November one year and late November during the 2nd year of study. Irrigation and fertilizer requirements were kept as per standard recommendation. Herbicides were applied 40 days after sowing of wheat. Monocot weeds were fully controlled by spraying clodinefop (Topik 15WP @ 250 g a.i. ha^{-1}) in the experimental unit and thus grassy weeds were not allowed to interfere with the results. Data on weed density m^{-2} before and 25 days after spray, number of total tillers m^{-2}, fertile tillers m^{-2}, 1000 grain weight and grain yield were recorded. The following new and old herbicides were tested alongwith hand weeding. A weedy check or control treatment was also included in the experiment.

Table-1. Treatments used for broad leaf weed control during 2003-04 and 2004-05

Trade name	Common name	dose a.i. g ha^{-1}
Buctril M40EC	bromoxynil + MCPA	494
Buctril Super 60EC	bromoxynil + MCPA	445
Lorgan Extra 64WG	terbutryn + triasulfuron	158
Shield 75WDG	tribenuron methyl	56
Strive M 30WP	fluroxypyr + MCPA	445
Lanceolate Star 15EQ	fluroxypyr+aminopyralid	148
Aim 40 DF	carfentrazone ethyl	20
Hand weeding`		
Control (weedy check)		

Previous years collected seeds of fifteen dicotyledonous weed species were sown in the experimental area at the sowing time of wheat. All fifteen species even then could not uniformly be maintained due to uneven germination. Only seven weeds were uniformly maintained in all three replications of the experimental area.

Table-2. Dicot Weeds Uniformly Managed in the Experiment.

Botanical Name	Vernacular name	Common name
Chenopodium album	Bathu	Goose foot
C. murale	Karund	Nettle leaf Goose foot
Fumaria indica	Shahtra, Papra	Fumitory
Lathyrus aphaca	Jangli matter	Meadow peavine
Convolvulus arvensis	Lehli	Field bind weed
Rumex dentatus	Jangli Palak	Broadleaf dock
Galium aparine	Lapaity	Catch weed bedstraw

In addition to these, other weeds like *Anagallis arvensis* (blue pimpernel), *Coronopus didymus* (swine cress), *Emex spinosa* (spiny emex), *Melilotus indica* (Indian sweet clover), *Medicago polymorpha* (common medic) and *Cirsium arvense* (Canada thistle) were also observed with respect to variably controlling behaviour of above mentioned herbicides. The pooled data for each parameter were subjected to the ANOVA technique and the means were separated by the LSD test (Steel and Torrie).

RESULTS AND DISCUSSIONS

Efficacy of Herbicides (%)

It is evident from the efficacy data (Table–3*)* that *C. album* and *C. murale (*Bathu, Krund*), F. indica* (Shahtra) and *R. dentatus* (Jangli Palak) were all effectively controlled by all the herbicides, even better than hand weeding. *L. aphaca* (Jangli Mattar) and *Galium aparine* were fully (100%) controlled by new herbicides viz. Strive–M @ 148 a.i g ha^{-1} and *Lanceolate star* @ a.i 148 g ha^{-1}. Herbicides Buctril M (@ a.i 494g ha^{-1}*,* Buctril super (@ a.i 445 g ha^{-1} and sulfonylurea herbicides esp. *Shield* 75 WG (@ a.i 56gha^{-1} @ 75 g ha^{-1} ware found less effective with their comparative efficacy of only 50, 66 and 75 %, respectively. *C. arvensis* was better controlled by Lanceolate star to the extent of 75% which was followed by Buctril super @ 445 a.i g ha^{-1} and Aim @ a.i 20 g ha^{-1} both having 66% efficacy. Sulfonylurea herbicides viz. Logran extra @ 158 g a.i ha^{-1} and Shield 75 WDG @56 g a.i ha^{-1} were found ineffective i.e. controlled it by 0 and 33% ,respectively.

Table-3. Comparative Efficacy % of Herbicides against Dicot Weeds in wheat.

Treatment g a.i. ha^{-1}	***C. album/C. murale***	***F. indica***	***L. aphaca***	***C. arvensis***	***R. dentatus***	***G. aparine***
Buctril–M @ 494	100	100	50	50	100	50
Buctril Super 60EC @ 445	100	100	66	66	100	60
Logran Extra@ 158	100	100	75	30	100	100
Shield75 WDG@ 56	100	100	50	33	100	66
Strive-M @148	100	100	100	50	100	100
Lanceolate @ 148	100	100	100	75	100	100
Aim 40DF @ 20	99	100	66	66	100	50
Hand Weeding	89	94	100	50	100	75
Weedy check	30	33	0	0	0	25

All the herbicidal treatments were found better than hand weeding (Table-3). These results are in line with Beatty (1983), CPC (2002) and Nayyar, *et al*. (2001).

Number of total tillers m^{-2}

Data regarding the number of total tillers m^{-2} (Table-4) indicated that all the seven herbicides were found safe on wheat, no phytotoxicity recorded and hence number of total tillers were found at par with the hand weeding. However, all the treatments produced 9 to 14% more tillers than the weedy check.

Number of fertile tillers m^{-2}

Maximum number of fertile tillers were produced by Lanceolate star (331 m^{-2}). All other herbicidal treatments were also found at par with it. Herbicidal treated units produced 33-44% more fertile tillers than the weedy check, which contributed a lot to the final grain yield. These results are also in accordance with Shad (1987) and Cheema and Akhtar (2005).

Table-4. Effect of herbicides on yield parameters and grain yield in wheat (Mean of 2003-04 and 2004-05).

Treatment g a.i. ha^{-1}	Total Tillers m^{-2}	Fertile Tillers m^{-2}	1000 Grain Wt. (g)	Grain Yield kg ha^{-1}
Buctril–M @ 494	391	320 a	31.2 abc	3348 abc
Buctril Super 60EpC @ 445	380	327 a	31.3 ab	3497 abc
Logran Extra@ 158	389	323 a	30.7 bc	3453 abc
Shield75 WDG@ 56	368	305 a	30.4 c	3144 bc
Strive-M @148	377	326 a	30.7 bc	3546 ab
Lanceolate @ 148	390	331 a	31.6 a	3641 a
Aim 40DF @ 19.76	380	315 a	30.8 bc	3373 abc
Hand Weeding	390	322 a	30.9 bc	3421 abc
Weedy check	343 NS	269 b	28.5 d	2865 bc
Cd1	49.46	29	0.61	362

1000-grain weight (g)

It is evident from the yield components (Table-4) that maximum 1000-grain weight of 31.6 g was recorded in Lanceolate star, which was better even than hand weeding. Most of the herbicidal treatments gave statistically similar grain weight, but 6-11% more than weedy check.

Grain yield (kg ha^{-1})

It is evident from the data that maximum grain yield of 3641 kg ha^{-1} was produced in Lanceolate star 15 EQ @ 148 a.i g ha^{-1}which was followed by Strive-M @ 148 a.i g ha^{-1} and Buctril super @ 445 a.i g ha^{-1} which yielded 3546 and 3497 kg ha^{-1}, respectively. It was further recorded that herbicidally treated units produced 10-27% more yield than the weedy check and 6 % more even than hand weeding. These findings are in analogy with Hamish and David (1991). Maximum tillering capacity of wheat was not affected by any herbicide, rather improved by 9-14% as compared to the weedy check. These results are also in corroboration with Shad (1987), Hassan *et al.* (2003), Hassan *et al.* (2006) and Khan *et al.* (2006).

Cirsium arvense was better controlled by Buctril-M @ 494g a.i ha^{-1} and Buctril super @445 g a.i ha^{-1} than Logran @ 158 g a.i ha^{-1}, Shield @ 56 g a.i ha^{-1} and Strive-M @ 148 g a.i ha^{-1}. Aim 40 DF @ 20 a.i g ha^{-1} was found fully ineffective against this weed. *C. arvensis* was effectively controlled by Buctril super, Aim and Lanceolate when these herbicides were applied too late (60 days after sowing in the non-experimental area as feeler experiment). *Emex spinosa* was effectively controlled by Buctril super *and* Lanceolate star at their normal doses at younger stage and at 1.5 times more dose at its advanced stage (but before its flowering). *Anagallis, Coronopus, Melilotus* and *Medicago* species were found easy prey to all the herbicides tested.

CONCLUSIONS

L. aphaca, and *G. aparine* being relatively tolerant to most prevailing herbicides at their recommended doses. These weeds were better controlled by new herbicides viz. Lanceolate star 15 EQ @ 148 g ha^{-1} and Strive-M @ 148 g a.i ha^{-1}. Herbicides when applied after first irrigation could not effectively control *C. arvensis*. It was effectively managed when treated with Aim 40D @ 50g, Buctril super 60 EC @ 445 g a.i ha^{-1} and Lanceolate Star 15 EQ @ 148 g a.i ha^{-1}60 days after sowing of wheat. Number of fertile tillers were found 3% more even than hand weeding in case of some herbicides. 1000-grain weight contributed 6-11% more in case of herbicides as compared to the control. Grain yield was found 10-27% more in the herbicidal treatments than control and in case of Lanceolate Star @ 148 g a.i ha^{-1}. It was found 6% more even than the hand weeding.

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