

Integrated weed management practices in garlic crop in Pakistan

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Abstract

Weed management studies in garlic crop were conducted during 2000–2001 and 2002–2003 at the National Agricultural Research Center, Islamabad Pakistan. During first year, pendimethalin was sprayed at $0.801 \text{ a.i. ha}^{-1}$ pre emergence 2 days after first irrigation in moist condition followed by different mechanical weeding regimes. During second year, pendimethalin, oxadiazon, glyphosate, and metribuzin were sprayed at 0.801, 0.251, 0.61, and $0.45 \text{ kg a.i. ha}^{-1}$, respectively, pre emergence 2 days after first irrigation in moist conditions followed by one hoeing at 80 days after herbicide application. Herbicide treatments were compared with weed free and weedy check. The most dominant weed species were *Phalaris minor*, *Cronopus didymus*, *Medicago denticulata*, and *Rumex dentatus*. All herbicide treatments followed by hoeing except metribuzin gave bulb yield at par with weed free treatment. Metribuzin resulted in minimum bulb yield (0.59 t ha^{-1}) because of its extreme phytotoxicity to garlic crop, which resulted in the survival of a few plants. Pendimethalin in combination with manual hoeing gave the highest bulb yield and monetary returns.

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Keywords: Pendimethalin; Oxadiazon; Glyphosate; Metribuzin; Weed fresh biomass; Bulb yield; Garlic; Pakistan

1. Introduction

Garlic (*Allium sativum* L.) is very popular and grown in all parts of Pakistan. It is widely used after onion and considered as a valuable spice for food. It is cultivated over an area of 6586 ha producing 55.9,000 t at an average yield of 8.49 t ha^{-1} (Anonymous, 2004). Garlic has very little canopy, which necessitates weeding as an important cultural practice for higher marketable bulb yield. Manual weeding is tedious, expensive and often damages the crop. Qasem (1996) studied the effect of 18 herbicides on weed control in garlic in Jordan and claimed that post-emergence application of oxadiazon at $0.241 \text{ a.i. ha}^{-1}$ at 3–4 leaf stage gave better yield as compared to weed free crop.

Vora and Mehta (1998) studied the efficacy of different herbicides for weed control in garlic and observed highest bulb yield in weed free treatment while herbicide application alone did not control weeds effectively. However, herbicides application followed by one hand hoeing gave

the best results (Vora and Mehta, 1999). Tewari et al. (1998) compared the efficacy of different weedicides with or without manual weeding and reported highest net monetary returns with hand weeding followed by pendimethalin at $0.801 \text{ a.i. ha}^{-1}$ supplemented with one hand hoeing. Sandhu et al. (1997) conducted a trial on the efficacy of herbicides for the control of weeds in garlic and claimed that pendimethalin with one hoeing after 105 days of sowing resulted in significant increase in bulb yield compared to weed free control. Mahmood et al. (2002) studied efficacy of two herbicides i.e. pendimethalin at $0.801 \text{ a.i. ha}^{-1}$ and oxadiazon at $0.251 \text{ a.i. ha}^{-1}$ were tested and compared with weed free (four manual hoeing) and weedy check. They reported that single application of any of the herbicides was not sufficient to obtain yield equal to weed free treatment.

In Pakistan, chemical weed control in garlic has received little attention and weeds are mostly managed manually, which is expensive. Sometimes due to shortage of labor and unexpected rains, hand weeding or mechanical weed operations are delayed or left altogether. In such situations, herbicides offer the most practical, effective, and economical method of weed control for increasing crop yield.

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The present investigation was undertaken to evaluate the comparative efficacy of four herbicides alone and in combination with different mechanical weeding regimes in garlic.

2. Materials and methods

The experiments were conducted at Vegetable Crop Research Programme, National Agricultural Research Center, Islamabad, and Pakistan during 2000–2001 and 2002–2003. The experiment was laid out in randomized complete block design with three replications. The plot size was 5.0 m². Cloves of garlic variety ‘Lehson Ghulabi’ were planted in the field in the second week of October during both seasons, keeping inter and intra row spacing of 10 and 25 cm, respectively. The crop was immediately irrigated after planting. During 2000–2001 and 2002–2003, six treatments (see Tables 1 and 2) were assessed for germination, weed biomass, bulb weight m⁻², number of bulbs m⁻², and bulb yield t ha⁻¹. Pendimethalin, oxadiazon, and glyphosate at 0.80, 0.25, and 0.6 01 a.i. ha⁻¹ while metribuzin at 0.45 kg a.i. ha⁻¹ respectively, were sprayed pre-emergence 2 days after first irrigation in moist condition.

In weed free treatment, first manual hoeing was done after 25 days of crop sowing while rest of three manual hoeing were done at 30 days interval to keep the crop weed free for entire growth period. The recommended doses of NPK at 100:90:60 kg ha⁻¹ in the form of urea, single super phosphate and potassium–sulphate, respectively, were applied. Full dose of phosphorus and potash along with half amount of nitrogen was applied at the time of land preparation while remaining half dose of nitrogen was applied at six-leaf stage of the crop.

The data were subjected to analysis of variance and the test of significance was applied following Duncan’s multiple range test (Steel and Torrie, 1980).

3. Results and discussion

3.1. Crop germination (%)

Germination percentage in all treatments was recorded after 15 days of sowing (Tables 1 and 2). The germination varied from 81% to 89% during 2000–2001 and 81% to 94% during 2002–2003. However, there was no significant difference in germination percentage in all treatments during both the years. These results indicate that

Table 1
Yield and other parameters of garlic crop as affected by different weed control methods in garlic crop (2000–2001)

Treatments	Germination (%)	Fresh biomass of weeds kg m ⁻²	Number of bulbs m ⁻²	Average bulb weight (g)	Yield (t ha ⁻¹)	Yield increase over weedy check (t ha ⁻¹)	Percent increase
Pendimethalin alone	88.67 ^{NS}	1.000 b	30.18 a	29.86 b	7.29 b	4.12	130
Pendimethalin + 1 hoeing	86.67	0.054 c	31.93 a	42.30 a	13.38 a	10.21	322
Pendimethalin + 2 hoeing	86.67	0.020 c	32.58 a	42.66 a	13.83 a	10.66	336
Pendimethalin + 3 hoeing	85.00	0.010 c	32.58 a	43.49 a	14.17 a	11.00	347
Weed-free	84.67	0.010 c	31.08 a	42.39 a	12.21 a	9.04	285
Weedy check	81.00	3.290 a	15.83 b	21.36 c	3.170 c	–	–

Values followed by the same letters in the respective column do not differ significantly at 5% level of significance according to DMR test.

Table 2
Yield and other parameters of garlic crop as affected by different weed control methods in garlic crop (2002–03)

Treatment	Germination (%)	Fresh biomass of weeds kg m ⁻²	Average bulb weight (g)	Number of bulbs m ⁻²	Yield (t ha ⁻¹)	Yield increase over weedy check (t ha ⁻¹)	Percent increase
Oxadiazon + 1 hoeing	84.07 ^{NS}	0.467 b	29.25 a	30.26 a	8.85 a	7.32	479.57
Glyphosate + 1 hoeing	83.52	1.067 b	26.67 a	27.74 a	7.39 a	5.87	384.41
Pendimethalin + 1 hoeing	80.81	0.733 b	31.97 a	29.74 a	9.51 a	7.98	522.79
Metribuzin + 1 hoeing	87.04	0.801 b	29.50 a	2.0 c	0.59 b	–0.93	–61.17
Weed-free	84.44	0.333 c	31.03 a	30.94 a	9.60 a	8.073	528.68
Weedy check	87.04	3.100 a	12.52 b	12.20 b	1.52 b	–	–

Values followed by the same letters in the respective column do not differ significantly at 5% level of significant according to DMR test.

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