

MANAGEMENT OF GRASSY AND BROADLEAF WEEDS IN POTATO IN THE HILLS OF HAZARA, PAKISTAN

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ABSTRACT

To figure out the efficacy of different herbicides in potato crop, an experiment was carried out at the Potato Research Centre, Abbottabad, Hazara, NWFP, Pakistan in a randomized complete block design. The planting of potato variety 'Cardinal' was done during mid February 2001. The treatments included Sencor 70WP (metribuzin), Stomp 330E (pendimethalin), Gramoxone (paraquat) and the weedy check. All the treatments were applied in pre-emergence except Gramoxone, which was applied as post emergence to weeds, but prior to the emergence of crop. Replicated 4 times, each treatment had a plot size of 5 x 3.75 m² in 75 cm spaced rows. During the course of studies data were recorded on the No. of broad leaves and grasses (m⁻²), 30 and 60 days after treatment. The fresh weight of broad leaves and grasses (g m⁻²) at 30 and 60 days after sowing. The data were also recorded on population of effective potato plants ha⁻¹ and potato yield (kg ha⁻¹). The statistical analyses of data revealed about 17-times (52.01 m⁻²) more broadleaf weeds infested the weedy check as compared to the best treatment Sencor 70WP (3.09 m⁻²), 30 days after treatment (30 DAT). The density of the Sencor WP was however, statistically at par with Gramoxone (6.56 m⁻²) and Stomp 330E (6.08 m⁻²). Similar trend was observed in the data recorded on the fresh weight of broadleaf weeds recorded 30 days after treatment, though the difference in weight was not as acute as in the number of weed per unit area. No. of effective potato plants were the same among all the treatments. Obviously none of the treatments adversely affected the potato crop, although the number of plants were slightly lower in Gramoxone. The highest tuber yield (11733 kg ha⁻¹) was recorded in the Sencor 70WP treated plots. It however, was statistically comparable with Gramoxone (10578 kg ha⁻¹) and Stomp 330E (10444 kg ha⁻¹). Gramoxone and Stomp 330E were in turn statistically at par with the weedy check (8156 kg ha⁻¹). Further studies are suggested under the same agro-ecological conditions, for the consistent findings.

Key words: grassy weeds, broadleaf weeds, chemical control; potato, *Solanum tuberosum*

INTRODUCTION

Potato (*Solanum tuberosum* L.) is an annual, herbaceous, dicotyledonous plant belonging to the family Solanaceae. There are many related species, but only the cultivated potato and a few others bear tubers (Malik, 1994). After maize, potato is the most widely distributed crop in the world. It is grown in about 140 countries, more than hundred of which are located in the tropical and subtropical zones. However, most production is still concentrated in the temperate regions in the industrialized countries. Almost one third of the crop is produced in developing countries, mainly the countries in Asia. The potato originated from the mountains of South America, where it has been an important food crop for long time. In 16th century the potato was introduced into Europe. In 18th and 19th centuries, it was already an important food crop, especially for the poor in various countries in Europe. During the 19th century the potato was introduced to several tropical and subtropical countries mainly by colonists from Europe. In more recent years potato has spread to many countries with warmer and drier climates and it has become important in regions such as the plains of India, Bangladesh, Pakistan, Central America and Argentina etc. (Beukema and Enderzaag, 1990).

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According to the estimates of the Pakistan Switzerland Potato Department Project (PSDP) potato ranks third among food crops after wheat and rice and fifth in total production (Malik, 1995)

It is an important tuber crop which contains all the essential constituents needed for maintaining proper health. It is a good and cheaper source of food calories and its high starch content can meet the energy requirements of the people living in the developing countries like Pakistan, India and Bangladesh (Rahman, 1986). For a country like Pakistan, with growing population, food gap and changing food habits, potato because of its high nutritive and high energy production per unit area has a special significance. It offers hope for meeting the food requirements of the general population. In this back drop potato has become an important strategic vegetable crop of Pakistan.

Nature has gifted Pakistan with extensive edaphic and ecological resources for ideal production of potatoes. Three crops of potatoes per year are being cultivated i.e. autumn, spring and summer in the plains of Punjab and NWFP generally two crops are raised in a year namely autumn and spring crops while the third one is cultivated in the hilly areas during the summer season. Autumn crop is sown in September and harvested in late December while Spring crop is sown in Dec/Jan and harvested in the month of May. The summer crop is sown in the hilly areas in May/June and harvested in October.

In Pakistan, potato is grown on a diverse area right from the sea level to an elevation of 3650 m in the mountains of Hazara and northern areas. The total area under potato cultivated in the year 1999-2000 was 111 thousand hectares and the total production recorded was 1868 thousand tons with an average yield of 16.9 tons ha⁻¹. The area and yield in N.W.F.P. during the same year was 10 thousand hectares and the production was 119 thousand tons, respectively, with an average yield of 12 tons ha⁻¹ (Anonymous, 2001). Based on 38% yield losses in potato about Rs 3.0 billion is lost due to weeds annually (Hassan and Marwat, 2001). As high potato yield as 2.8 times of control due to weeding has been communicated (Ashraf, 1988). Banaras (1993) reported 3 ton loss in potato yield due to each ton of weed biomass. Whereas Malik (1995) evaluated that due to *Orobancha aegyptiaca* (broomrape) a parasitic weed of potato, upto 30% yield loss occurred. Despite reducing yield of potato significantly, the weeds hinder harvesting of tubers (Knezevic et al. 1995). An increase of 18-82% tuber yield was deciphered due to weed management (Jaiswal and Lal, 1996a; 1996b). Herbicides pendimethalin, metolachlor, paraquat isoproturon and metribuzin have been tested worldwide with a successful control of prevailing weeds (Jaiswal 1994, Khurana et al. 1993; Yaduraju et al. 1993; Bellinder, et al. 1996, Bellinder, et al. 2000).

MATERIALS AND METHODS

An experiment was laid out at Potato Research Centre Abbottabad during mid February 2001 to investigate the efficacy of different herbicides for controlling weeds in potato variety Cardinal. The hills of Hazara are characterized by chilling cold winter and mild summer seasons. The treatments included Sencor 70 WP (metribuzin), Stomp 330E (pendimethalin), Gramaxone (paraquat) and the weedy check (Table-1). The herbicides except Gramaxone were applied in pre-emergence of the crop and weeds Gramaxone was applied in post-emergence of weeds prior to the emergence of crop. The seed rate of 1800 kg ha⁻¹ was used. All other cultural practices were applied equally to all the treatments.

Table 1. Detail of Treatments used in the experiment.

Treatment/Trade Name	Common Name	Commercial Product kg/L ⁻¹	Active ingredient kg ha
No weeding	-----	-----	-----
Stomp 330E	pendimethalin	4.0 L	1.32
Sencor 70WP	metribuzin	0.6 kg	0.42
Gramaxone	paraquat	4.2 L	1.0

The experiment was laid down in a randomized complete block design with four replications. Each treatment had a plot size of 5 x 3.75 m² in 75 cm spaced rows. During the course of studies data were recorded on the No. of broad leaves and grasses (m²), 30 and 60 days after treatment. The fresh weight of broad leaves and grasses (g m⁻²) at 30 and 60 days after sowing. The data were also recorded on population of effective potato plants ha⁻¹ and potato yield (kg ha⁻¹). The data for all the aforesaid traits were individually subjected to the analysis of variance technique and the significant means were separated by the LSD test (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Weed dynamics

The data exhibit (Table-2) that there was a preponderance of broadleaf weeds among the flora infesting the crop. About 17-times (52.01 m⁻²) broadleaf weeds were recorded in the weedy check as compared the best the best treatment Sencor WP (3.09 m⁻²), 30 days after treatment (30 DAT). The infestation of the Sencor WP was however statistically at par with Gramaxone (6.56 m²) and Stomp 330E (6.08 m²). Similar trend was observed in the data recorded on the fresh weight of broadleaf weeds recorded 30 days after treatment, though the difference in weight was not as acute as in the number of weed per unit area. Only 2.5 times difference in weight was recorded between the top scoring treatment Gramaxone (0.69 kg m⁻²) and the weedy check (1.99 kg m⁻²) [Table 2]. All the treated plots although non significant among themselves had a lesser biomass of broad leaf weeds as compared to the weedy check. The variability of the number of weeds not commensurating with the weight could be attributed to the plasticity of weeds i.e the lesser number attained more weight per plant due to reduced competition with the other broadleaf weed species and the individuals within the same species. The biological niche vacated by the weeds could not be effectively utilized by the potato plants, rather than much of it was pre-empted by the broad leaf weeds themselves. The perusal of data in Table-2 further reveals that that the fresh weight of grasses 30 DAT was non-significant statistically. All the treatments including the weedy check possessed the similar weight per unit area indicating that none of the herbicides could effectively control the grass species in our studies. The data on broadleaf weeds recorded 60 DAT exhibit that the hith herbicides gave a season long control of the broadleaf weeds (Table-2). There has been a reduction in the No. of broadleaf weeds m² in Sencor 70 WP. The number however increased in Stomp 330 (5 m²) treated plots. The broadleaf infestation in the treated plots was statistically similar, but higher than the weedy check. In the weedy check (86.25 m²) there has been a more than 50% recruitment in broadleaf weeds as compared to the data recorded 30 DAT (Table-2). The data on grasses recorded 60 DAT show non-significant differences among the treatments. There has been a random variation among the density of grasses showing that none of the herbicides had any effect on grasses even in the later stages of growth (Table-2). These findings are supported by the previous work of Eberlin et al (1997) who reported weed biomass reduction in the range of 98 to 99% relative to weedy check while applying Stomp and Sencor. The studies of Banaras (1993) who deduced a strong relationship between the dry matter yield of weeds and the potato crop.

Potato yield related traits

The data in Table-2 illustrate that the No. of effective potato plants were the same among all the treatments. Obviously none of the treatments adversely affected the potato crop, although the number of plants were slightly lower. The highest tuber yield (11733 kg ha⁻¹) was recorded in the

Sencor 70WP treated plots. It however, was statistically comparable with Gramaxone (10578 kg ha⁻¹) and Stomp 330E (10444 kg ha⁻¹). Gramaxone and Stomp 330E were in turn statistically at par with the weedy check (8156 kg ha⁻¹). These findings are in a great agreement with the work of Chirita (1995) who reported 87% weed control and 14% yield increase with Sencor+Frontier 900 compared to weedy check, whereas Gutierrez and Eberlein (1997) have reported yield increase with application of rimsulfuron+ metribuzin (Sencor). Similarly Tyla and Tamosiunas (1996) and Ackley et al. (1996) reported yield increase in potato due to use of Sencor. Yaduraju et. al. (1993) also obtained a variable yield of potato by using different herbicides.

Table 2. Effect of different herbicides on weed dynamics and tuber yield of potato.

Treatment	No. of broadleaves 30 DAT	Fresh weight of BL kg m ⁻² 30DAT	Fresh weight of G kg m ⁻² 30 DAT	No. of BI m ⁻² 60 DAT	No. of Grasses m ⁻² 60 DAT	Effective potato Population ha ⁻¹	Tuber yield kg ha ⁻¹
Sencor	3.09	0.73	0.40	2.0b	36	33600	11733.33a
Gramaxone	6.56	0.69	0.53	5.5b	42	27467	10577.78ab
Stomp 330E	6.08	0.73	0.50	8.25b	31	31867	10444.44ab
Weedy check	52.91	1.99	0.58	86.25a	39	32533	8155.56b
LSD _{0.05}	16.73	NS	NS	16.73	NS	NS	2505.78

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