EFFECTS OF WEED MANAGEMENT PRACTICES ON YIELD AND YIELD ATTRIBUTES OF WHEAT AT KIMUGAUN, DAILEKH, NEPAL

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Abstract

Among the several weed management techniques for wheat, the chemical method is seen to be the most effective. In order to assess the impact of various weed control techniques on wheat yield and yield-attributing characteristics in 2015-16 and 2016-17, a field experiment was carried out at the Horticulture Research Station in Kimugaun, Dailekh. The results of year 2015-16 showed that the combinations of weed management methods had significant effect on the grain yield of wheat. The treatment (application of pre-emergence pendimethalin on the second day after sowing and hand weeding on the 55th day after sowing) produced significantly higher yield of 3.9 t/ha, followed by the use of a cono-weeder on the 35th and 55th days after sowing (3.6 t/ha). Similarly, grain yield of 3.5 t/ha was produced by applying isoproturan post-emergence 35th days after sowing and manually weeding on 55th days after sowing. Additionally, the application of the post-emergence isoproturan on the 35th day after sowing, produced a grain yield of 3.5 t/ha, which was significantly at par. The treatment (use of cono-weeder on 35th and 55th days after sowing) produced the highest grain yield (5.1 t/ha) during the 2016-17 growing season. The treatments (pre-emergence application of pendimethalin on second and 55th after sowing and application of post-emergence 2,4-D on 35th days after sowing) produced the grain yield of 4.8 t/ha. Similarly, 4.8 t/ha of yield was obtained by using pre-emergence pendimethalin on the second days of sowing. Additionally, grain yield of 4.8 t/ha was obtained from treatment (post emergence application of 2,4-D on 35th days after sowing. Furthermore, the grain yield of 4.7 t/ha was obtained by application of post-emergence isoproturan on the 35th day and hand weeding on the 55th day after sowing. The result of two-year study showed that use of cono-weeding was found to be an effective weed control method for both pre-emergence and post-emergence weedicide use on wheat production. However, this research needs to be further verified in farmers' fields at various areas in western areas of Nepal.

Key words: *chemical, cono-weeder, management, weed, wheat, yield*

Introduction

According to MoALD 2023, wheat (*Triticum aestivum L.*), is one of the main cereal crops, ranking third in terms of planted area and production after rice and maize in Nepal while it is the most extensively grown grain worldwide and ranks second in Nepal in terms of human consumption (Kandel et al., 2024). In the worldwide context, it provides 21% of dietary protein and 19% of calorie intake, making it a staple food for the majority of people (Jabran et al., 2017), meaning that over one-fifth of the world's population uses it as a staple food (McFall and Fowler, 2009; Shiferaw et al., 2013). Wheat is also known as the "king of cereal crops" because of its greater ecological adaptability, ease of production, and higher nutrient content-carbohydrates and protein being the main nutrients (Sultana et al., 2012). Wheat is a staple grain for many people. According to Khawar et al. (2017), a worldwide drop in wheat yield may have an impact on food security.

Weeds can either directly or indirectly lower wheat yield and quality by creating habitat for pests and diseases and occasionally acting as an alternate host for them, increasing the likelihood that the wheat crop will become infected with pests or diseases (Abbas et al., 2009; Bekelle 2004). Gezu and Soboka (2001) showed that weeds reduced wheat output by between 10 to 65 percent. They also found that crop loss from weeds was typically higher than the total crop loss from disease and insect pests (Savary et al., 1997). Weeds use more nitrogen, potassium, and magnesium than field crops (Schwezel and Thomas 1971), and they compete with crops primarily for water, CO2, light, and nutrients for different growth requirements (Fahad et al., 2013). This leads to significant yield and quality losses (Verma et al., 2015; Ryan et al., 2009). Additionally, weeds reduce the fertility of the soil (Gautam and Singh, 1981). The immature crop is subject to intense competition from weeds, and occasionally late-germinating weeds can also reduce quality and yield (Tomar et al., 2003). In Pakistan (Khan et al., 2011), in India (Mishra, 1997), in Nepal (Ranjit, 2002), in Bangladesh (Karim, 1992), and in other countries, the percentage of wheat output lost to weeds might range from 25 to 30%. According to Avola et al. (2008), the modern agricultural system uses a variety of agronomic techniques to produce an environment that is conducive to the growth of diverse crops and weeds. The likelihood that the best-suited weed will predominate in a cropping system is increased by monocropping, or growing the same crop continually (Harker and Clayton 2008; Shahzad et al., 2016).

Lack of weed control measures drastically reduces wheat yield (Sultana et al., 2012), while a successful weed management plan can boost crop productivity by roughly 37% (Baluch, 1993) to 65% (Mirkamali, 1987). Chemical methods have become important because physical methods of management are time-consuming, costly, and occasionally less successful due to imitation (Amare et al., 2014; Marwat et al., 2008). Techniques for managing weeds may include manual, chemical, mechanical, cultural, and/or physical control. The use of chemical weed management is thought to be a successful weed control practice for wheat crops. According to Moss 2019, using herbicides to control weeds is the most effective and straightforward method.

Modern agriculture is placing a strong emphasis on chemical weed management (Taj et al., 1986). For efficient and environmentally responsible weed control in wheat, integrated approaches should be used. (Khawar et al., 2017). In light of these factors, a study was carried out at the Horticulture Research Station to assess the impact of weed control techniques on wheat yield and yield characteristics at Kimugaun, Dailekh, Nepal.

Materials and methods

During the year 2015–16 and 2016–17 wheat growing seasons, the experiment was carried out at the Horticulture Research Station, Kimugaun, Dailekh, which is 2.3 kilometers from the Dailekh District headquarters in Karnali Province, Nepal. Nine treatments were used in the experiment, each of which was reproduced three times using a randomized complete block design. With a seed rate of 120 kg per hectare, wheat was constantly sown in individual plots measuring 4 m in length and 2.5 m in width, with rows spaced 25 cm apart. For experimental purposes, the released variety WK 1204 was used with a recommended fertilizer dose of 80:40:20 N_2:P_2O_5:K_2O Kg per hectare. The treatment detail is given in Table 1. Straw was removed from the field and crops were hand harvested with sickles five centimeters above the ground. The data were recorded on days to heading (DH), days to maturity (DM), plant height (PH) in cm, spike length in cm, number of grains per spike, grain yield in t/ha and straw yield in t/ha. All the observed data was analyzed using statistical software GenStat discovery.

Table 1: Treatments for weed management experiment on wheat

Treatments	Treatments detail	Rate (kg a.i. per hectare)
T1	Hand weeding at 55th DAS	...
T2	Post-emergence application of isoproturan at 35th DAS	1.00
T3	Post-emergence application of isoproturan at 35th DAS+ HW at 55th DAS	1.00
T4	Cono-weeder at 35th DAS and 55th DAS	
T5	Pre-emergence application of pendimethalin at second DAS	1.00
T6	Pre-emergence application of pendimethalin at second DAS + HW at 55th DAS	1.00
T7	Post emergence application of 2,4-D at 35th DAS	0.70
T8	Weedy check	...
T9	Weed free	....

Note: DAS: days after sowing, DM: days to maturity, PH: plant height (cm), GPS: grain per spike, SL: spike length (cm), TGW: thousand grain wt. (g), GY: grain yield (t/ha), SW: straw yield (t/ha). ** -Highly significant, *- Significant and NS-non significant

Results and discussion

The results of year 2015-16 showed that the combinations of weed management methods had significant effect on the grain yield of wheat. The treatment (application of pre-emergence pendimethalin on the second day after sowing and hand weeding on the 55th day after sowing) produced significantly higher yield of 3.9 t/ha, followed by the use of a cono-weeder on the 35th and 55th days after sowing (3.6 t/ha). Similarly, grain yield of 3.5 t/ha was produced by applying isoproturan post-emergence 35th days after sowing and manually weeding on 55th days after sowing. Additionally, the application of the post-emergence isoproturan on the 35th day after sowing, produced a grain yield of 3.5 t/ha, which was significantly at par. The yield for weedy check was 3.1 t/ha (Table 2). Ghosh et al. (2017) reported a similar result, concluding that the usage of metsulfuronmethyl @ 4 g a.i./ha as a post-emergence herbicide and pendimethalin 1 kg a.i./ha as a pre-emergence herbicide were superior alternatives for controlling weeds. Fahad et al. (2013) observed improved wheat production and efficient weed control using isoproturon 50 WP @ 1.0 kg a.i. ha^{-1} as post emergence. Additionally, our results also support the conclusions of Hasan et al. (2003) and Marwat et al. (2008).

Table 2: Effects of weed management practices on yield and yield attributes on wheat at Kimugaun, Dailekh, Nepal during 2015/16

Treatments	DH	DM	PH	SL	GPS	SY	GY
T1	110	143	79.5	8.7	60.3	2.6	2.9
T2	111	143	82.5	10.6	61.2	3.3	3.5
T3	112	143	84.2	9.5	48.2	2.6	3.5
T4	112	144	81.6	10.1	71.3	3.1	3.6
T5	109	146	83.6	9.8	56.0	2.6	3.1
T6	108	145	85.1	10.9	61.1	2.9	3.9
T7	108	143	85.7	10.5	59.9	3.1	3.2
T8	108	145	88.6	10.5	57.5	3.4	3.1
T9	108	145	91.1	11.6	59.7	3.5	3.1
Mean	109.7	144.2	84.6	10.2	59.4	3.0	3.3
F-test	NS	NS	NS	NS	NS	NS	*
LSD(0.05)	…	…	…	…	…	…	0.5
CV(%)	2.3	1	5.5	14.8	11.5	22.5	9.3

Note: DH: days to heading, DM: days to maturity, PH: plant height (cm), GPS: grain per spike, SL: spike length (cm), GY: grain yield (t/ha), SW: straw yield (t/ha). ** -Highly significant, *- Significant and NS-non significant

The treatment (use of cono-weeder on 35th and 55th days after sowing) produced the highest grain yield (5.1 t/ha) during the 2016-17 growing season. The treatments (pre-emergence application of pendimethalin on second and 55th after sowing and application of post-emergence 2,4-D on 35th days after sowing) produced the grain yield of 4.8 t/ha. Similarly, 4.8 t/ha of yield was obtained by using pre-emergence pendimethalin on the second days of sowing. Additionally, grain yield of 4.8 t/ha was obtained from treatment (post emergence application of 2,4-D on 35th days after sowing. Furthermore, the grain yield of 4.7 t/ha was obtained by application of post-emergence isoproturan on the 35th day and hand weeding on the 55th day after sowing. Weedy check yielded 3.6 t/ha (Table 3). Similar findings were also reported by Pisal and Sagarka (2013), who found that pendimethalin sprayed as pre-emergence weedicide was effective against monocot and dicot weeds and post-emergence herbicide applications of 2,4-D amine salt and metsulfuron-methyl were effective against dicot weeds. Our results are comparable to research by Hussain et al. (2003) and Nadeem et al. (2006), who found that post-emergence application of isoproturon increased grain yield in wheat when compared to the control treatment. While using the system of wheat intensification (SWI) strategy in western Nepal, Khadka and Raut (2011) discovered that introducing a simple, manually operated, women-friendly seed drill and cono-weeder could reduce the weed problem. They concluded that this approach was both successful and cost-effective.

Table 3: Effects of weed management practices on yield and yield attributes on wheat at Kimugaun, Dailekh, Nepal during 2016/17

Treatments	DH	DM	PH	SL	GPS	SY	GY

Treatments	DH	DM	PH	SL	GPS	SY	GY
T1	103	156	86.4	9.8	62.0	10.2	3.9
T2	104	154	96.3	10.1	64.0	10.7	4.3
T3	106	153	95.9	9.7	66.0	10.3	4.7
T4	106	152	99.0	9.0	61.0	11.0	5.1
T5	104	150	96.3	9.8	58.0	12.9	4.8
T6	101	150	97.2	9.4	57.0	10.3	4.8
T7	102	150	96.7	9.7	58.0	13.0	4.8
T8	100	151	94.7	8.9	56.0	10.5	3.6
T9	98	153	94.7	9.0	54.0	12.5	4.0
Mean	102.7	152.1	95.2	9.5	59.6	11.3	4.4
F-test	NS	*	NS	NS	NS	NS	*
LSD(0.05)	…	3.9	…	…	…	…	0.79
CV(%)	0.4	0.4	2.8	6	16.3	9.1	1.8

Note: DH: days to heading, DM: days to maturity, PH: plant height (cm), GPS: grain per spike, SL: spike length (cm), GY: grain yield (t/ha), SW: straw yield (t/ha). ** -Highly significant, *- Significant and NS-non significant

Conclusions

The yield of the wheat harvest was higher with weed management practices than with weedy check, according to an analysis of the results from both years. The highest grain yield (3.9 t/ha) was recorded in 2015–16 when pendimethalin was applied as pre-emergence weedicide on the second day after sowing and hand weeded on the 55th day after sowing. In 2016–17, the highest grain yield (5.1 t/ha) was recorded when cono-weeder was applied on the 35th day. The yield results from other weed management techniques, such as post-emergence application of 2,4-D on the 35th day after sowing and post-emergence application of isoproturan on the 35th day after sowing with hand weeding on the 55th day after sowing, were as par. Kabir et al. (2014) highlighted the importance of weeding in wheat by reporting increased grain yields in weed-free and weeding-treated plots when compared to un-weeded plots. However, for a good return, the right weed management technique and application timing are crucial factors (Abbas et al., 2009; Marwat et al., 2008). Cono-weeding was shown to be just as effective on wheat production as both pre-emergence and post-emergence weedicides, according to the results of a two-year study. This suggests that cono-weeding could be a technique for integrated weed management in wheat. However, this research needs to be further verified in farmers' fields at various areas in western part of Nepal.

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Authors' Contributions

C.B. Rana, K. Subedi guided the research; A. Chaudhary and S.R. Sharma conducted the trial and recorded data; A. Chaudhary wrote the manuscript; and A. Mishra, P. Wagle revised the manuscript.

Conflict of interest

The authors declare no conflicts of interest.

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