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Short Communication

Assessment of different weed management practices in yield and yield attributes in summer maize in inner Terai of Nepal

A. Shrestha [a,*], B. Thapa[b], S. Kandel[b]

a Nepal Agriculture Research Council, Nepal.

b Institute of Agriculture and Animal Science, TU

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ABSTRACT

The experiment was conducted in farmer field with farmer managed in Randomized Complete Block Design (RCBD) with three treatments and seven replications. The treatments were weed management practices including (i) Farmer's Practice (FP) (ii) Two manual weeding (iii) First manual weeding and 2nd weeding by post emergence herbicides (Temboterine and Atrazine) application in Inner-terai, Dang, Nepal. Results showed that first manual weeding and 2nd weeding by herbicides significantly reduced weed infestation and gave higher maize grain yield. The yield attributes were cob length, total number of grain, number of grain per row, cob weight with husk and cob weight without husk. Thus, herbicides used after 1st manual weeding is successful for high maize yield.

Introduction

Maize (*Zea mays* L.) is the second most important cereal crop in Nepal in terms of area and production. Maize provides staple food to large population in hilly areas. Despite its importance, the yield of maize is lower due to various factors such as weed, soil fertility, nutrient management practices and lack of advanced technologies. Among them, weed is the major limiting factor in maize production. Maize is highly susceptible to weed competition, especially at early growth stages. Weeds that emerge at the time of crop germination or within a few days of crop emergence cause greater yield loss than weeds emerging later in the growing season (Knezevic et al. 1994; Donvan et al. 1985; Swanton et al. 1999). Mishra (2004) reported that weedy environment in maize resulted yield reduction up to 70 per cent in eastern mid hills of Nepal. Weed compete with the

Corresponding author, email: shrestha.avi1425@gmail.com (A. Shrestha).

maize plants mainly for space, nutrients, moisture and sunlight influencing the morphology and phenology of crop that results in lower yield, reduce the quality of grains and make the harvest difficult. Furthermore, high weed infestation increases the cost of cultivation, lowers the value of land and ultimately reduces the benefit to farmers. As a result, weed management is extremely important in order to realize the grain yield potential of maize. The critical period of crop–weed competition and weed threshold are two important aspects in a weed management program in maize. The critical period is the time period after crop emergence during which crop must be kept weed-free to prevent yield loss, described as loss greater than 5% in earlier studies (Hall et al. 1992). Likewise, weed threshold is the weed density above an acceptable count that provides an opportunity to decide the right time to take appropriate control measures to avoid yield loss (Knezevic et al. 1994; Oliver, 1988). Attention must be given on weed management practices in order to maintain the competitive ability of the threatened crop by minimizing weed interference during the growing phases of crop. The knowledge of critical period of weed interference could help reduce yield losses caused by weed (Knezevic et al. 2002). In order to get optimal yield, maize plot should be kept free from weed between 21 DAS and 42 DSA which is the critical period of weed interference (Imoloame and Omolaiye, 2017). The nature of weed interference strongly influences the choice of weed control measures i.e., cultural, biological and chemical methods. Manual weeding is laborious, expensive and time consuming. Chemical control is better alternative to manual weeding because of its cheaper, faster and better weed control ability (Chikoye et al. 2004). However, continuous use of herbicide could change weed flora, poor controlling and even evolution of herbicidal resistant weeds as well as the resistance of weeds to herbicides. There is, therefore, need to evaluate the impact of herbicides, as an alternative weed control measure, on the growth and yield of maize. This study was conducted with an aim to evaluate the yield comparison of maize on manual weeding, farmer's practice and manual weeding followed by post-emergence herbicide application.

Materials and Methods

The experiment was conducted in farmer's field in Randomized Complete Block Design (RCBD) with three treatments and seven replications. Three treatment consists of Farmer's practice of weed control (single weeding), two manual weeding (15 and 30 DAS) and 1st manual weeding at 15 DAS + 2nd weeding by herbicidal application (Temboterine and Atrazine) at 30 DAS. Maize was sown by broadcasting with seed rate of 25 kg/ha. The size of plot was 80 m^2. Two plots were separated by a bund of 0.5 m width and replications were farmer field which was more than 1 m apart. The area, where research site was located, received about 1485 mm rainfall during the entire

crop growth period. The average relative humidity for that duration was 85.20 per cent. Fertilizer management was done as per farmer's field practice. From the experimental site, 10 m^2 area at the center was taken as net plot rows for harvesting and 10 plants were selected for biometrical The yield attributes like cob weight, cob length, barren length, number of row per cob, number of grain per cob, thousand seed weight, grain and stover yield were recorded during the experiment. Statistical analysis of the data was carried out by SPSS package; correlation and regression analysis was done by using Microsoft Excel. Mean was separated by performing analysis of variance (ANOVA) at 5 % significance level (Gomez, 1984)

Results and Discussion

Yield attributes

The result on yield attributing characters is presented on Table 1. The yield attributing characters viz. cob weight with and without husk, mean cob length, number of grain/cob, number of grain/row and sterility percentage were highly influenced by different weed management practices. The highest cob weight with husk (20.20 kg), cob weight without husk (15.92 kg), mean cob length (18.77 cm), mean number of grain per cob (463) and mean number grain per row (31.83) were found on manual + herbicide application followed by only manual practice whereas least yield attributing characters were found on farmer's practice (FP). The superiority on yield attributing characters of manual + herbicide weed management practice over other practices is due to timely and effectively control of weed. This result is in agreement with Amare et al. (2014), who recorded lowest weed weight in plots treated with hand weeding followed by application of post emergence herbicide.

Table 1. Effect of weed management practices on yield attributes of Summer Maize

Treatment	Cob weight with husk (kg)	Cob weight without husk (kg)	Mean cob length (cm)	Mean no of grain per cob	Grain/ row	Sterility (%)
FP	12.35^{b}	9.69^{b}	17.30^{b}	361^{b}	27.40^{b}	22.70^{a}
Manual weeding	16.02^{b}	13.25^{ab}	18.27^{a}	395^{ab}	29.07^{ab}	19.18^{b}
Manual+ herbicide	20.20^{a}	15.92^{a}	18.77^{a}	463^{a}	31.83^{a}	18.66^{b}
SEm(±)	1.54	1.261	0.259	23.2	0.967	0.937
LSD(0.05)	4.853*	3.972*	0.816**	73*	3.046*	2.952*
CV(%)	40.8	37.1	10.4	17.5	11.2	9.2
p-value	0.015*	0.018*	0.008	0.031	0.026	0.024
Grand mean	16.17	12.95	18.11	407	29.43	20.18

The sterility percentage on maize is lowest (18.66 %) in manual + herbicide application to control weed followed by manual weeding (19.18 %) and highest sterility percentage (22.70 %) on farmer's practice. This is due to less weed competition period in treatment of manual + herbicide that allowed maize plant to produce more photosynthetic material by using the available nutrients.

Table 2. Effect of weed management practices on yield of Summer Maize in Inner-Terai, Nepal.

Treatment	Grain yield (t/ha)	Fresh Stover weight (t/ha)	Harvest index
FP	3.928[c]	20.40	19.61[b]
Manual weeding	5.408[b]	20.87	25.06[a]
Manual +herbicide	6.540[a]	22.7	28.50[a]
SEm(±)	0.258	0.935	0.860
LSD(0.05)	0.812**	ns	2.709*
CV(%)	5.4	20.7	32.1
p-value	<0.001	0.458	0.007
Grand mean	5.29	28.11	14.39

Effect of weed management practices on yield of maize is represented on Table 2. The highest grain yield (6.54 t/ha), stover yield (22.7 t/ha) was recorded from manual+herbicide application Grain yield is also a function of the number of cobs per plants and the number of grains per cob. Greater values recorded for these parameters in herbicide treated plots imply that decrease in weed density favours these parameters. Jehangeri et al. (1984) reported that application of selective herbicides provided 65 to 90 % weed control and 100 to 150 % more grain yield of maize than un-weeded control. Similar results were also reported by Subhan et al. (2007). They reported that herbicides and hand weeding cause an increase in grain yield as compared to weedy check. The integration of herbicides with one supplementary hoe weeding have been found to be very effective in the control of weeds and promoting higher yields in various crops (Imoloame, 2014; Peer et al. 2013; Veeramani et al. 2001). The lowest grain yield was obtained from farmer's practice due to only one manual weeding which directly affected the growth and yield of maize.

Conclusion

The results of this study reveals that weed control through application of post emergence herbicide after first manual weeding contributed immensely to the growth and yield of maize by reducing the weed interference as compare to manual weeding and farmer's practice. The use of

post emergence herbicide, Temboterine + atrazine, in the Terai region of Nepal is successful to control weed and increase the grain yield of maize.

Conflict of Interest

Authors declare no conflict of interest.

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