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Comparative Efficiency of Different Weed Management Practices on Yield and Economic in Summer Maize in Dang

Shrestha A[1*], Thapa B[2], Devkota M[3] and Subedi R[4]

[1]*Institute of Agriculture and Animal science, Post Graduate Campus, Kathmandu, Nepal*

[2]*Institute of Agriculture and Animal science, Lamjung, Nepal*

[3]*CIMMYT, Nepal*

[4] *Department of Agronomy, Institute of Agriculture and Animal Science, IAAS, Nepal*

[*]**Corresponding author:** Shrestha A, Institute of Agriculture and Animal science, Post Graduate Campus, Kathmandu, Nepal, Tel: 977-9842996262; E-mail: shrestha.avi1425@gmail.com

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Abstract

The particular weed management practice is still know that describes the exact solution for weed control and maximizes the yield and profitability of maize production and weed severs to more than 40% loss in production. So, the field experiment was conducted in Farmer's field to compare the effects of different weed management practices on weed growth and dynamics, yield, and economic performance in Summer Maize under humid sub-tropical condition at Aswara-5, Tulsipur, and Dang in 2017. The experiment was conducted in Randomized Complete Block Design with seven treatments and three replications. The treatments consisted of (i) Framer practices, (ii) control, (iii) weed free broadcasting (iv) Weed free line sowing (v) power weeded (vi) Manually weeded (vii) herbicides (Temboterine and Atrazine). The different weed managements practice showed significant effect in Yield, test weight, Harvest index, stover yield, shelling percent and sterility percent and cob length. The higher grain yield was obtained in herbicide treated plot (7.620 t/ha) and least in control plot (3.54 t/ha) and farmer practice plot (4.32 t/ha) where other treatment were statistically at par with each other. The highest shelling and cob length was 78.33 and 21.76 cm found highest that leads to highest yield and lower yield in control and farmer plot. The cost of cultivation was higher in weed free line sowing (NRs 89102) and broadcasting (NRs 89106) condition but the production per unit cost was highest in herbicides (109.27 g/Rs) plot and followed by manual (69.73 g/Rs) and power weeded plot(78.11 g/Rs). Similarly, the highest Net revenue, Gross revenue and Benefit cost ratio was obtained in Herbicide treated plot among all the treatment, which is followed by power weeded plot. So, we can conclude that, herbicide treated plot is economically and profitability important in terms of production where there is human labour crisis.

Keywords: Weed; Herbicides; Weed free line; Weed free broadcasting; Manual weeded; Power weeded

Introduction

Maize is an important cereal crop, efforts are being made to narrow the yield gap between potential yield and actual farm yield. The ultimate yields of maize are controlled by a number of genetic and external factors [1]. The yield of maize is greatly affected by weeds in the field. Weeds are a constant source of concern for the successful growth and development of economic crop.

They compete with crops for light, moisture, space and nutrients and consequently interfere with the normal growth of crops. Weed control therefore, is very essential in maize cultivation. The critical period of weed interference in maize is influenced by the competing weed species, the cultivars, plant density and environmental factors such as light, water, nutrient and allelopathy [2]. Yield loss of up to about 39.8% has been reported in maize [3].

Maize is very susceptible to competition from weeds especially in the early stages of growth; therefore, efficient control at the pre- and early post-emergence stages is essential. Once maize reaches approximately 0.5 m in height, weed control no longer affects yield [4]. Weed interference not only results in crop losses but also increases insect pest damage, harvesting difficulties and crop contamination [5]. It is generally conceded that the recurrent economic damage to agriculture from weeds far surpasses the more incidental damage inflicted by insect pest, rodents and diseases [3]. Attention must therefore be focused on weed control measures so as to maintain the competitive ability of the threatened crop by minimizing weed interference during the growth phases of crop. The nature of weed interference influences strongly the choice of weed control measures. The methods of weed control are cultural, biological and chemical. Chemicals are increasingly being used in Nepal and other developing countries for the control of weeds in maize because they offer an effective and relatively inexpensive means for managing cereals weed problems.

Several herbicides have been identified for weed control in maize and are applied at various stages of development; hence, they are classified according to their time of application as pre plant, pre-emergence, or post emergence [6]. Much work has been done on the efficacy of these herbicides on their weed control ability. There is, therefore, the need to evaluate the impact of these herbicides, as an alternative weed control measure, on the growth and yield of maize and mechanical method was found to be more costly.

The research work was conducted to investigate into how the growth and yield of maize are affected by the use of some herbicides and manual and power weeded used in controlling weeds and compare the economic efficiency in Maize.

Materials and Methods

A farmer's field experiment was conducted to see the effects of different weed management practices on weed dynamics, crop yield, and economic performance of Summer Maize (Cv. Rajkumar) under humid sub-tropical condition at Aswar-05, tulsipur, Dang in 2017. The experiment was conducted on slightly acidic (pH 5.2) sandy loam soil. The soil was low in available N (0.18%), high in available phosphorus (59.1 kg/ha), and low in available potash (153 kg/ha).

The experiment was conducted in Randomized Complete Block Design (RCBD) with seven treatments and three replications. The treatments consisted of (i) Framer practices, (ii) control, (iii) weed free broadcasting (iv) weed free line sowing (v) power weeded (vi) manually weeded (vii) herbicides (Temboterine and Atrazine). Maize was sown in line with Jap planter keeping rows 75 cm and plant to plant 25 cm apart where treatment is line sowing. The seed rate was 25.0 kg/ha. Sowing of maize seeds was done in plots of 80 m^2 size. In power weeded plot, mini-tiller was used for weeding and time was recorded, and in manual weeded plot, manual weeder was used and time was recorded. In weed free condition, no weed was given to grown. Two plots were separated by a bund of 0.5 m width and replications were farmer field which was more than 100 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%. The crop was fertilized with 120.80.60 kg NPK/ha through Urea, Di-ammonium phosphate (DAP) and Muriate of potash (MOP). Fifty percent of the N, and whole P and K were used as basal dose and the remaining 50% of N was top dressed at grand growth stage, and another half at tasseling stage (55 DAS). From the experimental site, 10 m^2 area at the centre was taken as net plot rows for harvesting and 5 plants from both side second row was selected for biometrical and phonological observations. Major weeds in the Maize field were identified. Weed density and dry weight of these weeds were measured especially up to maximum vegetative stage. Cob weight, cob length, barren length, no. of row per cob, no. of grain per cob, thousand seed weight, grain and stover yields were recorded during the Experimentation. Statistical analysis of the data was carried out by SPSS package, and correlation and regression analysis was done by using Minitab. Mean was separated by performing analysis of variance (ANOVA) at 5% significance level [7].

Results and Discussion

The average shelling % was found highest in herbicide treated plot (78.32%) and lowest was found in control plot. Along with the weed management practices, the shelling % is found to be increased comparison to the control plot. The farmer plot have 2.73% more, weed free broadcasting plot have 4.36% high, similarly power weeded have 5.45, manually weeded plot have 4.43% more shelling % as compared to control plot. Weed management practice increased the shelling % of the maize. Similarly, sterility % is contradicting to the shelling percent and to the weed management practices. The sterility percent was highest in control plot. The sterility % is decreased along the weed management practice was conducted. The lowest sterility % was found in Herbicides treated plot. The sterility % of farmer plot, weed free broadcasting, weed free line sowing, power weeded and manually weeded were 10.16%, 7.3%, 11.19%, 8.5% and 8.39% less comparison to control plot. The Stover yield was significantly difference with different treatment. The control plot has least Stover yield and weed free broadcasting has highest Stover yield. Other plots were statistically at par with highest value and mid-value in Stover Yield. The cob length was highly significant with the different treatment. The control plot has least cob length (19.52 cm) and highest cob length in Herbicides (21.72 cm) and weed free broadcasting (21.44 cm). After weed management practices, the cob length of Farmer, weed free line, Power weeded and manually weeded were 1.76 cm. 3.84 cm, 2.8 cm and 2.32 cm more compare to control plot. The 1000 kernel mean weight was highest in weed free line sowing (357.4 g) and least in control plot (311.3 g), where other plot were statistically at part. This result is in line with Shrivastav et al. [8] and Bay and Bouhache [9]. Such trend was also marked in grains weight per cob and thousand grains weight (Table 1).

Treatment	Cob length (cm)	Test weight	Shelling %	Sterility %	Yield (t/ha)	Stover yield (kg)	Harvest index
Farmer	19.52c	338.6ab	62.46ab	12.15bc	4.32c	31.30ab	11.46c
Control	17.76d	311.3c	59.73b	22.31a	3.54c	20.20c	13.57c
Weed free broadcasting	21.44a	338.6ab	64.09ab	15.01b	6.080b	34.56a	13.74c
Weed free line	21.60a	357.4a	61.12b	11.19bc	5.340b	30.20ab	13.55c
Power weeded	20.56ab	326.8bc	65.18ab	13.81bc	5.640b	26.40bc	16.30b
Manual weeded	20.08b	323.5bc	64.16ab	13.92bc	5.34b	31.40ab	13.74c
Herbicides	21.76a	337.4ab	78.32a	10.18c	7.620a	29ab	19.67a
Grand mean	20.39	333.3	65	14.08	5.41	29.01	14.54
SEM (±)	0.387	7.52	5.19	1.344	0.322	2.214	0.749
LSD (0.05)	1.13	21.96	15.14	3.924	0.941	6.464	2.185
CV	1.9	2.8	5.9	15.8	8.4	5.3	5.1

P-value	<0.001	0.009	0.025	<0.001	<0.001	0.004	<0.001

Table 1: Effect of different weed management practices on yield and yield attributes in summer maize in dang, 2017.

The different treatments have highly significant effect in the yield of maize. The Yield in farmer (4.32 t/ha) and control plot (3.54 t/ha) were found to be lowest. After the start of the weeding practices, the yield was increased for weed free line sowing, power weeded, manually weeded and weed free broadcasting with respect to control plot. The yield were found 1.8 t/ha, 2.54 t/ha, 2.1 t/ha, 1.8 t/ha for weed free lone sowing, weed free broadcasting, power weeded and manual weeded respectively over control plot. The highest yield was found to be highest in herbicides treated plot (7.62 t/ha). All yield attributes were increased significantly in weed free as compared to weedy check which was due to control of weeds growth either by hand weeding or using herbicides assist to enhance crop growth and development as a result of which more photosynthesis could be used in the formation of grains [10]. This result agrees with the findings of Hasanuzzaman et al. [11], which stated that herbicide application produced higher straw yield than hand weeding. Gaire et al. [12] has also reported higher yields were observed in the treatments, in which Eupatorium mulch (3.5 t/ha) and Na bispyribac herbicide (3.43 t/ha) were used.

The grain yield decreases due to the weed infestation throughout the whole vegetation period by 90% [13,14]. Hussein [15] reported that controlling weed in maize field could save 75, 11 and 54 kg per ha of N, P and K and 90, 1029 and 99 g/ha of Zn, Fe and Mn respectively. Also, Zimdahl [16] mentioned that competition for water is often considered the most important source of weed-crop comp edition. Weeds growing with a crop have been shown to reduce soil mixture, although the depth of additional water extraction depends on the specific combination of crops have been shown to reduce soil moisture, although the depth of additional water extraction depends on the specific combination of crop and weeds present. The reductions in soil moisture have been related to increase in weed density or the length of time weeds remain present with crop. Dalley et al. [13] reported the herbicides use significantly increased the grain yield by 78 or 75%, respectively in comparison with the un-weeded check. Dalley et al. [13] reported that season-long weed competition in corn reduced soil moisture and reduced soil moisture contributed to reduced grain yield in the control plot. Jehangeri et al. [17] reported that application of selective herbicides provided 65 to 90% weed control and gave 100-150% more maize yield than weedy check.

Treatment	Cost of Cultivation	Net return	Net Revenue	B:C	Production (G) per unit cost (NRs)
Farmer	79106ab	28894cd	108000c	1.365d	54.61
Control	68950b	19550d	88500c	1.284d	51.34
Weed free broadcasting	89106a	62894b	152000b	1.705bc	68.23
Weed free line	89012a	44488bc	133500b	1.498cd	59.99
Power weeder	72200ab	68800b	141000b	1.953b	78.11
Manual weeder	76575ab	57425b	134000b	1.750bc	69.73
Herbicides	69731b	120769a	190500a	2.732a	109.27
Grand mean	77812	57546	135357	1.755	
SEM (±)	327	7996.9	8056	0.101	
LSD (0.05)	954.5	23341.4	23513.7	0.295	
CV	0.6	19.5	8.4	8.1	
P-value	<0.001	<0.001	<0.001	<0.001	

Table 2: Effect of different weed management practices in economic in summer maize in Dang, 2017.

Economic is one of the important factors in case of production. The economic analysis is ultimate goal of all faming system. If the cost of production is less and gross return is not high, then there is less existence of nay business or farm. As presented in the Table 2, the cost of cultivation for the different treatment were varies from NRs 68950 per ha to NRs 89106 per ha. The highest cost of cultivation was found in weed free broadcasting and weed free line sowing plot where less cost of cultivation was found in herbicidal and as well as in control plots. The cost of cultivation in manual and power has no significant different in cost of cultivation. It is might due to lack of human manpower where the cost per labour is very high as well as the charge for the machinery use is very high. The machinery using farmer was lesser in number so that the facilities provider charges higher per weeding. Weed free condition can require more labour and high cost but production per unit cost is less than other plot accept control plot. The production per unit cost was found higher in herbicides treated plot because this plot has high production but least cost of cultivation. The Gross return is high where the yield was high. The gross income for different treatment was varies from NRs 88500 to NRs 190500. The Gross revenue is directly interlinked with the production. The control

plot gives the very least gross return as compared to other treatment. The highest yield was found in herbicides treated plot which finally leads to the high gross return. Similarly, the net return is also related to the gross revenue and cost of cultivation. The herbicides plot (NRs 120769 per ha) have highest gross return as it have high revenue and least cost of cultivation and least in control plot (NRs 19550 per ha). The higher net return was followed by power weeded and manually weeded plot. Weeding is better than non-weeding from all aspect. Framer plot have NRs 9344 per ha more profit than control plot. Weed free condition does not give significant difference between manually weeded and power weeded plot. Weed free condition for all time doesn't lead to higher yield where it increases the cost of cultivation. Gaire et al. [12] reported that the weed infestation was found higher at early growth stages (15 DAS) and 30 DAS and decline after it, so weed management practice is use after it. The benefit cost ratio was ranged from 1.2 to 2.73. The highest B:C ration was in herbicides plot, followed by power weeded plot and least were farmer practice and control plot. Due to uncontrolled weed condition in weedy check, the grain yield decreased significantly as compared to other weeding treatments. Similar findings were reported by Reddy et al. [18], Singh et al. [19], Shrivastav et al. [8] and Upadhaya et al. [20].

Conclusion

On the basis of the results obtained from the field experiments, the following conclusions were drawn:

1. Assessment of the effect of different weed management practices on maize indicated that the herbicides contributed immensely to the growth and yield of the crop by providing adequate weed control and, hence, reducing the competition offered by dense weed growth.

2. After the economic comparison, herbicides application was found to be much effective during the time of labour crisement and to reduce the cost of cultivation. Whereas, power weeded can also be alternative choice for the weed management but to lack of it knowledge and monopolistic price of the technical people caused the cost of cultivation high. So, in the present context, herbicides application increased the yield of the maize and reduces the cost of cultivation and returns the huge revenue and profit to farmer.

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