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Effect of Different Ways of Weeds Control on Corn Grain Yield

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Abstract: ***Maize is a major plant in Afghanistan and its seed is worldwide cultivated for various purposes. It is cultivation is on the increase, but in Afghanistan due to the lack of an effective use of corn, and continuous drought, its cultivation has been reduced. Weeds are a part of pests which impose damage to crops yearly and the losses were up to 30% in some cases, but in some cases it made up to 90% of the agricultural products. The aim ofthis research is to recognize the different control practices of weeds in maize plant and its effect on grain yield. The research was carried out in 64m^2 area of agricultural research farm of Faculty of Agriculture at Kabul University in 2017. The experiment design was CRD with 4 replications that included Herbicide (H) 2, 4-D, plastic mulch (M), hand weed control hoe (HW) and control (C). The amount of urea fertilizer was applied as 250 kg ha^{-1} in two phases that the amount of first step was 125 kg ha^{-1} during at 4 leaf stage and during at 12 leaf stage it was applied as amount of 125 kg ha^{-1}. The M treatment weeds were controlled by hand, weeds of HW treatment was controlled by hoe and H treatment weeds was controlled by 2, 4-D herbicide during at 5-8 leaf stage of corn to control broadleaf weeds. The parameters measured include plant height, number of ear and number of grains. The result of M treatment yield was higher among all treatments then HW, H and C treatments yield were recorded. In conclusion, we recognized that the use of different ways of weed control like mulch and herbicide (2, 4-D) have positive effects on corn grain yield.***

Keywords: Corn, Weeds, Mulch, 2, 4-D and Hoe

1. Introduction

Corn (Zeamays) is the third leading cereal crop in the world after wheat and rice. Corn is the main second important cereal crops in Afghanistan as well. The corn yield is decreased considerably by attacking various weeds as much corn as the average obtained in our country between 2014 and 2015 years was 0.136 million tons and the cultivation area was 0.127 million hectares(5). The drought continued for corn has just been confined to the existed water areas.On the other hand, the lack of appropriate market compared with other grains is less interested in corn cultivation. Primarily corn is cultivated for seed production and secondly for forage and raw industrial materials. Grain maize is consumed for human and animal consumption (15).Maize cultivation depends on tropical, subtropical and warm temperate zones that have sufficient quantity of rain or water.Central America was the origin of maize. Corn has been the main cereal crop for food supply in North, Central and South parts of America (9).

Corn cultivation area pretending as worldwide in118.6 million hectares of land and the yield is estimated 1021.61 million tons. Oil obtained from corn seeds looked very good. The maize grain chemical composition quality basis on a dry weight is 77% of starches, 2% sugar, 9 % protein, 5 % fat and 2% ash. The corn seeds also have an amount of10-12 percent protein, vitamins A, E, C, irreplaceable amino acids, mineral salts and trace elements. (4, 14).

The content of the economic value of corn raised to 25 percent of global strains of maize provided food. The people of some countries like Tanzania, Nigeria, Utopia, Mexico, Afghanistan and etc. They made bread from flour of corn which is used for eating. Nevertheless, the corn seed oil is extremely high in most baked form it is used (7).

As of grain corn (Ascorbic acid), starches and glucose, are also recoverable.Corn green fodder and silage is used to feed animals. One kilogram of dry grain corn has about 78 grof digestible protein for animal feed, which is considered valuable. Corn rich in nutrients required for body and are also rich in fiber. Corn oil is rich in linoleic acid, one of the two acid is essential for healthy skin. Corn oil is used for local skin allergies, and lowers blood cholesterol. Cornsilk is diuretic due to existing high potassium. The decoction of the leaves of corn is used for bladder stone (2, 15).

Corn produced is higher in countries which use the best methods of cultivation and appropriate ways of weed control. It should be mentioned that in Afghanistan from the major weed control methods only used the competitive weed control method and partly mechanical ways. (3).

Weeds are competing with corn for light, water and nutrients and even because of leaving phytotoxine in the soil, reduce the growth rate of corn. In the absence of water, nutrients and enough light, there is some competition from weeds because of high necessity of nutrients and light is more intense than others(7, 8). Weed absorption of a little water and nutrients from soil instead of the corn particularly in areas where water scarcity and soil enough essential elements of the plant does not exist is very important. On the other hand, the existence of weeds caused some shelter for insects and diseases that affected the corn plant (2, 11, 13).
The main ways of weed control methods for corn include cultivation of corn hybrid varieties which has a strong character that changes corn incredibly to a competitor plant. Corn planting with row system compared to that without row system increased corn grain yield and on the other hand, raised the possibility of weed control using improved mechanical ways such as cultivator. It must be said that the above mentioned system is effective under the current conditions of our country because with this system it is

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possible to use fertilizer very easily and control weeds between rows by hoe. We have to be careful about mechanical weeding because weeds must be cut and put it under soil and on the other hand prevent from corn roots damages. Mechanical weeding must be started when corn is 10cm until corn length riches 50-60cm and it must be repeated 3-4 times. (6, 9).Therefore, efforts must be done to learn the best ways of weeds suppression for farmer to increase their agricultural products (10).

Currently, most agricultural developed countries are controlling weeds from cornfields by using herbicides. As a number of farmers controlling weeds between rows during the growing season by cultivators and weeds of above rows can be control by herbicides during corn seeding. In some cases, areas were sprayed with herbicides during corn seed planting. Herbicides are commonly used in this system and are as follows: Alachlor, Atrazine, Igran, Syanazine, 2, 4-D, Metolachlor and so on (1, 12, 13).

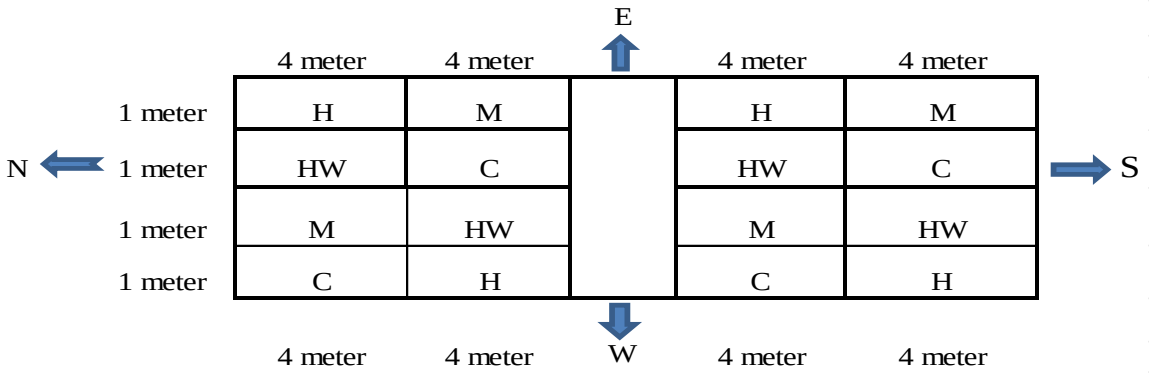
Among all problems in corn cultivation in Afghanistan, one of them is diversity of weed existing in corn fields which damage a lot of corn yield. Therefore, current research is focused on three ways of weed control (Mechanical control, Mulch and using of 2, 4-D) (1).

The research aims are to understand the various ways of weed control and its effect on corn yield, comparison the effectiveness of different ways of weeds control on corn yield and introduced the convenient and economic way to farmers. Expected results are likely to mulch treatments and the use of the compound 2, 4-D result will be high.

2. Materials and Methods

The research was conducted in the area of 64m^2 in research farm of Agriculture Faculty of Kabul University on 22 June 2016. The design of experience was CRD with4replications (Tab. 1). Treatments were included Herbicide (H) 2, 4-D, Mulch (M) plastic, Hand weed control (HW) Hoe and Control (C). The sub-plot size was 8m^2 that length of each ridge was 8m and a width was 1m. Width of each ridge was 75 cm and size of between ridge was25 cm.

Table 1: Design of Excrement



4X 16 = 64 meter m2

First targeted area was irrigated and then plowed by tractor in a suitable time and finally make bridges by shovel to land ready for sowing. Number of seeds planted in each pot (4m^2) was 60that include 3 seeds in each hole to a depth of 5 cm and 20 cm between each plant was planted on May22, 2016. DAP fertilizer was applied during planting time as amount of 480 gr in 120 plants which include 4gr per each plant. The amount of urea fertilizer was applied as 250 kg ha^{-1} in two phases that the amount of first step was 125 kg ha^{-1} during at 4 leaf stage and during at 12 leaf stage it was applied as amount of 125 kg ha^{-1}. Different kinds of weeds was seen in the research area which included broadleaf and wheat-leaf like *Chenopodium album L.*,*Portulaca oleraceae L.*,*Convulvulus arvensis* ، *Lupinus spp.*, *Poligunium avcular L.*, *Cyndon dectylon (L)*, *Aamaranthus retreroflexusL.*

The M treatment weeds were controlled by hand on May 11, 2016, weeds of HW treatment was controlled by hoe on June 25, 2016 and H treatment weeds was controlled by 2, 4-D herbicide during at 5-8 leaf stage twice as amount of 6cc in 400 ml of water to control broadleaf weeds in corn field. The wheat-leaf weeds of H treatment were controlled by hand and the total areas of farm research weeds was controlled in 3-4 times except of C treatment. At the first hoeing, the extra plants were removed from each plot and just put one plant in each hole. Irrigation was applied between 8-10 days based on the need. Corn plant height (from soil surface to the plant growth apex) was measured with a ruler. Four plants were randomly chosen from each row of each plot and their heights were measured every week from mid-July to the end of the silking stage. Corn grain yields from each plot 4 plants harvested randomly on September 15, 2016. Corn ears were separated from the plants and their husk removed, and then fresh weights were measured. Then, all corn ears were oven-dried at 75 ° C for 2 days and the dry weights were measured. All grains were detached from the cobs by hand and the dry weight of seeds and cobs were measured. Statistical analysis was carried out by ANOVA and Least Significant Difference (LSD).

3. Results and Discussions

Plant Height in 8 leaf stage

It became cleared after analysis that corn plant height in 8 leaf stage in mulch treatments (M) were highest 72.8cm and after that the treatments which2, 4-D(H) have been used come second by having 69.8cm plant height and then the treatments which weeds were controlled by hand (HW) have

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64.2 cm height. The smallest increase in plant height was in control treatments (C) the last treatments that their weeds was not controlled (C) plant height was the smallest60.1 cm (Fig. 2).

The reason of higher plant height in M treatment was availability of soil moisture continually but in case of other treatments plant height may be affected by lack of moisture and as well as competition of weeds up to this stage, therefore, the plant height was not increased as the same of M treatment. There were no significant differences among treatments.

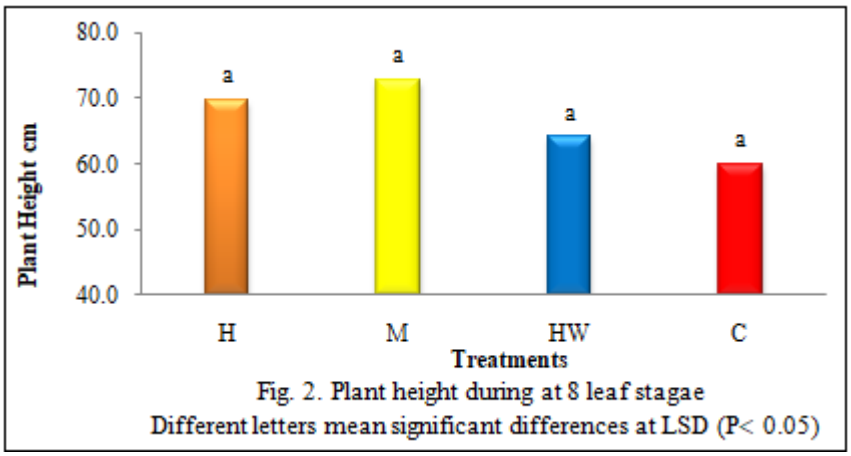

Fig. 2. Plant height during at 8 leaf stagae
Different letters mean significant differences at LSD (P< 0.05)

Plant Height in 12 leaf stage

In 12 leaf stage, the plant height was at the first growth stage in M treatment with150.8 cm height, the plant height of HW treatment with146.2 cm height become in second stage, H treatment that 2, 4-D herbicides has been used their plant height was in third stage with 143.2 cm height and finally the plant height was smallest in C treatment with119.2 cm height (Fig. 3).

M treatment by reason of preserving of moisture for a long time and also absents of weeds completely has the highest plant height and the other treatments come in completion of weed so their height was a little lower. There was significant difference between C and M and HW and H treatments but between HW, M and H treatments in case of weed control sources there was no significant differences among treatments.

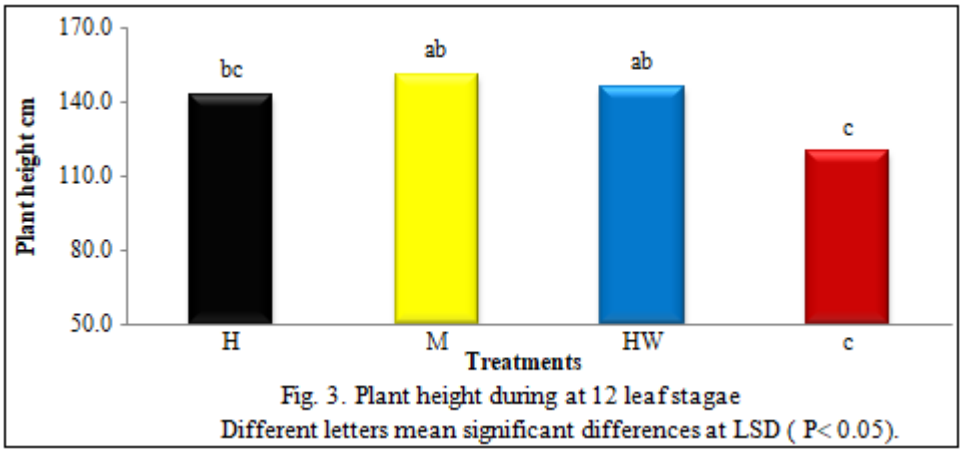

Fig. 3. Plant height during at 12 leaf stagae
Different letters mean significant differences at LSD (P< 0.05).

Plant Height in silky stage

In silky stage again the plant height was higher in M treatment with 197.3 cm height and then plant height of HW, H and C treatmentswith177.2, 171, and 149.8cm height were followed respectively. Using2, 4-Duntil this stage remove only broad leaf weed but in same time there were many different kinds of weeds in the field however, they were controlled by hand but it has negative effect on plant height (Fig. 4).

According to LSD test significant differences has seen between M and C, C and HW and M and H treatments but between HW and M treatments there were no significant differences because their weeds controlled in suitable time with a best management.

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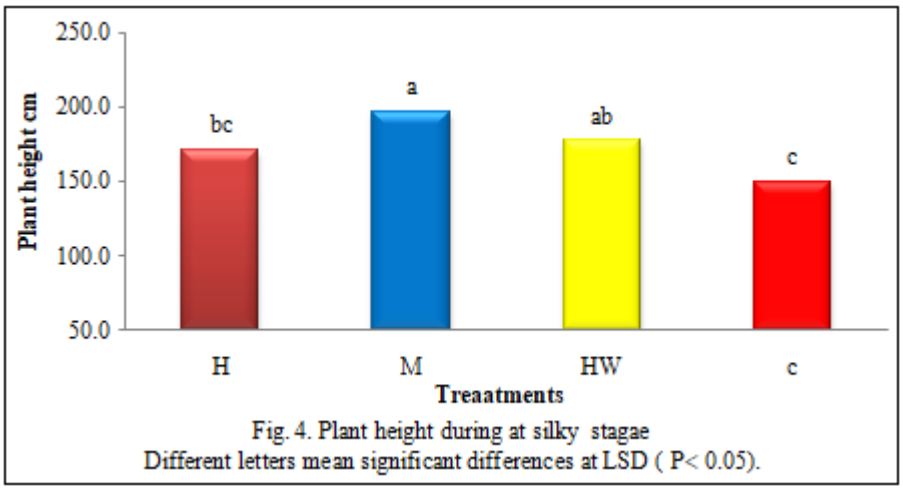

Fig. 4. Plant height during at silky stagae
Different letters mean significant differences at LSD (P< 0.05).

Number of Corn Ears

After harvesting the large amount of corn ear was seen in M treatment. There were significant different differences between C and M and M and C treatments (Fig. 5). According to M treatment it was observed earlier that M treatment had the highest plant height in different stages. Plant height is one of indicator for number of corn ears. After M treatment the number of corn ear of HW treatment was higher than H and C treatments respectively.

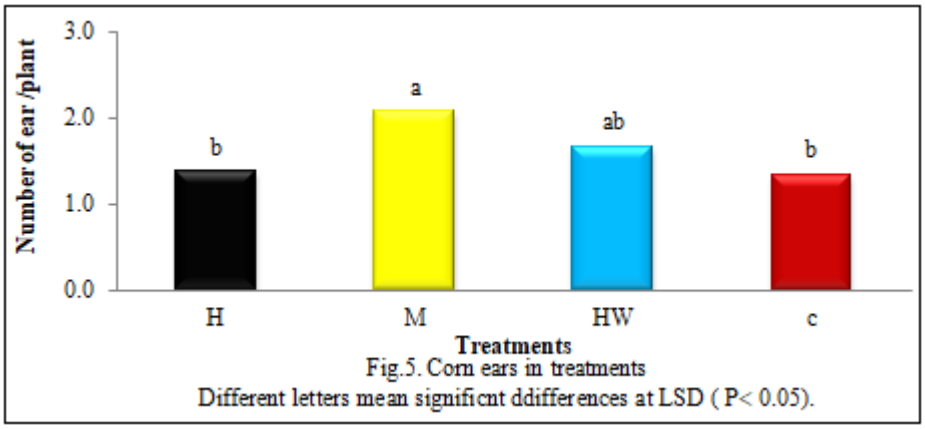

Fig.5. Corn ears in treatments
Different letters mean significnt ddifferences at LSD (P< 0.05).

Corn Grain Yield

It was observed that corn grain yield was higher in M treatment because the plant height of M treatment was higher than others and also the number of corn ears was higher in M treatment, however, there was no significant difference between treatments except C and M treatments but it was also no significant because the weeds of C treatment was not controlled (Fig. 6).

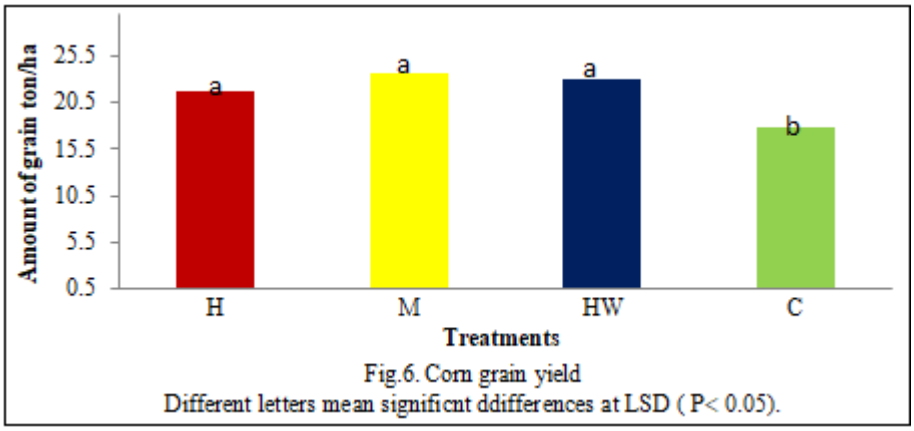

Fig.6. Corn grain yield
Different letters mean significnt ddifferences at LSD (P< 0.05).

Based on analysis of variances, there were significant differences of yield among all treatments at 5 percent levels(Tab. 1). According to the results, its conclude that use of M and 2,4-D herbicide increased corn grain yield. Coefficient of variance (CV),has also been calculated, the result showed the smallest CV, which indicate the preciseness of this research. Low CV shows that this research has been performed accurately.

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Table 2: Analysis of variance (ANOVA) of yield

S.V	df	SS	M.S	F. Calculate	F. Table		Probability
Total	(n-1)= 15	2.43			5 %	1 %	
Treatment	(t-1)= 3	1.44	0.479	5.78*	3.49	5.95	0.01
Error	(dfT-dft)= 12	0.99	0.083				

S.V: Source of variation, df: Degree of freedom, S.S: Sum of squares, M.S: Mean of squares

$$CV = \frac{\sqrt{error\ MS}}{Grand\ Mean} \times 100 = \frac{\sqrt{0.083}}{6.5} \times 100 = 4.4$$

4. Conclusion and Recommendations

Corn grain is one of the important staple foods in many semi-arid countries like Afghanistan (11). As mentioned earlier, corn plant has many different uses therefore; it is recorded among important plants. Corn plant also expose in competition with weeds in different stages of growth. In Afghanistan corn grain yield is decreased by two reasons; corn is not yet cultivated in row system and also corn weeds were not controlled by modern system.

Result of this research is shown that performance of different types of weed control has different effects on corn grain yield. First of all, using mulch method (plastic) hasthe best effects on increasing corn grain yield, secondly, weed control by hoe, shovel and other and then using (2, 4-D) herbicides respectively. The above weed control methods had good effects on corn agronomical characters like plant height,number of leaf, number of ear and grain weight, in the same time treatments that their weeds were not controlled they had been putted in compotation with weeds which result cause the decreases of corn grain yield.

It is recommended that different methods of weed control should be used. Mulch system is in small field where corn is cultivated in rows is very effective but in large field usage herbicides are cheap and economic which its benefits already confirmed by many researches.

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