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TILLAGE AND MULCHING EFFECT ON WEED DYNAMICS AND YIELD COMPONENTS OF MAIZE CROP IN DISTRICT PESHAWAR UNDER SEMI ARID ENVIRONMENT

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ABSTRACT

An experiment was conducted on effect of tillage and mulching on emergence, weed population and yield components of maize crop in district Peshawar under Semi arid environment during 2012. The experiment was laid out in factorial experiment with randomized complete block design having nine treatments and four replications. Three tillage practices (Cultivator 4 times followed by planking, mould board plough followed by rotavator and cultivator twice followed by planking) and three mulching levels (wheat mulch, barseem mulch and control) were used. Tillage practices were alloted to main plots and mulching levels to subplots. Tillage practices had a significant effect on harvest index (%), weed population (m^{-2}) while showing no significant effect on number of cobs $plant^{-1}$ and days to emergence. Maximum number of cobs $plant^{-1}$(1), harvest index (22.71 %), weed population ($39.50m^{-2}$) and days to emergence (5.07). Similarly, mulching have also showed no significant effect on number of cob $plant^{-1}$ (1), and days to emergence (5.08) while showed significant effect onharvest index (22.20%) and weed population ($33.08m^{-2}$). It was concluded that the combination of wheat straw mulch and mould board plough followed by rotavator were proved fruitful for increasing yield components of maize crop and reducing weed population under semi-arid environment.

Key words: Cobs $plant^{-1}$, days to emergence, harvest index, mulching, tillage, and weeds.

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district Peshawar under simi-arid environment. Pak. J. Weed Sci. Res. 22(1): 95-102.

INTRODUCTION

Machinery like tillage plays a crucial role in increasing crop yield and production. A soil tillage practice such as primary and secondary tillage improves soil physical properties and enables the plant to show their full potential and growth. Tillage practices provide a good seed bed for root growth and development, eradicate weeds, manage crop residues as a fertilizer, reduce soil erosion and level and firm the surface of the soil for planting, irrigation; drainage and incorporation of organic and inorganic fertilizers in the soil (Teasmeter et al., 2001).Since it is important to use of soil tillage practices strongly which effecton yield and soil physical properties. So it is important to use sufficient tillage practices in the soil to avoid the degradation of soil structure and crop yield (Lal, 1981a; b; Greenland *et al*., 1981).

Tillage practices break up high density soil layers below, improve water holding and infiltration in the soil, enhances root growth and development, and increase crop production potentials. To meet the food requirement of ever increasing human population, there is a great need of high crop productivity rate, which is only possible when soil is properly ploughed in the rain-fed areas and to conserved moisture in the subsoil. Proper tillage practices and moisture conservation is required for good yield in semi-arid zone. Now a days about 70-75 % of land in the tribal areas is simi-arid only one crop that is wheat is raised. But there is need to grow more food crops in arid zone due to explosive increase in population in tribal belt as well as Khyber Pakhtunkhwa. This is a 21stcentury which is the century of economic growth and development, education and social uplift of the people which lead to a sustainable and prosperous society (Ramzan *et al.,* 2012).

Similarly on the other hand mulching is also a desirable management practices used to regulate and enhances crop yield and their production (Khan, 2001). It is a modern and recent non-chemical weed eradication method, reduce leaching and transpiration from the soil surface (Liu *et al*., 2000). These practicesconserve soil moisture contents, increase organic matter in the soil and reducing nutrient losses due to run off (Roldan *et al*., 2003; Smart and Bradford, 1999). Mulching provides organic matter and nutrient supply for the plant growth and development. Mulch is one of the major protective covering to maintain soil temperature, prevent and control soil erosion, control weeds and enrich the soil for better production (Becher *et al*., 2005).

Keeping in view the importance of different tillage and mulching practices for improving crop yields under semi-arid environment is the need of today food crises in rain-fed areas which is a global issue. Therefore on this issue the study was conducted in semi-arid environment in the Malakandher Farm, The University of Agriculture, Peshawar to combat the shortages of food requirement.

Proper amount of water is required for normal growth of plants and yield of crops. Less irrigation applied to crops leads to stunted growth and thus results reduction in yield. In rain-fed areas there is deficiency of soil moisture especially for maize crop. Therefore there is a need of proper moisture conservation for maize crop in semi-arid environment. The present study was designed to conserve the moisture through different mulching practices in semi-arid environment in The University of Agriculture, Peshawar-Pakistan.

MATERIALS AND METHODS

Field experiment was conducted at New Developmental Farm, The University of Agriculture Peshawar during Kharif 2012. Available maize variety 'Azam' for semi arid environment was sown on well prepared seed bed with row to row and plant to plant distance of 75 and 20 cm respectively. Prior to planting the seeds were treated with vitavix. A basal dose of 170 kg ha^{-1} of nitrogen and 60kg ha^{-1} of phosphorous was applied. Half of nitrogen and full dose of phosphorous were applied before sowing while half dose of nitrogen was applied at knee height. The following combinations of the treatments used were T1M1, T1M2,$T1M_o$, T2M1, T2M2, $T2M_o$, T3M1, T3M2, and $T3M_0$. The following factors were studied during research:

Factor "A" Tillage Practices

1) T 1= Cultivator 4 times followed by planking
2) T 2= Mould board plough followed by rotavator
3) T 3= Cultivator twice followed by planking

Factor "B" Crop residues application (as a mulching)

1) M1 = Wheat mulch
2) M2 = Barseem mulch
3) M_o = No mulch

The data were recorded on number of cobs $plant^{-1}$, days to emergence, weed population, and harvest index.

Statistical analysis

The recorded data for each trait were subjected individually to the ANOVA technique by using MSTATC computer software (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Days to emergence:

Days to emergence may be influenced by soil fertility, bulk density, porosity, as well as climatic conditions. Days to emergence were affected non-significantly by tillage treatments and mulching practices under semi-arid environment (Table-1).

Table-1. Days to emergence as affected by tillage and mulching practices.

Treatments	Tillage			Mean
	Cultivator 4 times	MB plow + Rotavator	Cultivator twice	
Wheat mulch	5.00	5.05	5.18	5.08
Barseem mulch	4.88	5.10	4.98	4.99
No-mulch	5.00	5.00	5.05	5.02
Mean	4.96	5.05	5.07	

Statistical analysis of the data revealed that there were non-significant differences between the values of days to emergence during this experiment (Table-1). This may be due to the strict genetic control of the trait under reference being not affected by the environment. These results are in agreement with Chaudhary (1985) and Allmars (1985) who reported that the rate of emergence was affected by soil bulk density, moisture contents, and aggregate size.

Number of cobs plant^{-1}

Number of cobs per plant may also be influenced by soil fertility, soil bulk density, soil porosity as well as climatic condition like rain and irrigation. Number of cobs plant^{-1} was not affected significantly by tillage treatments as well as mulching practices under semi-arid environment.

Table-2. Weed Population (m^{-2}) as affected by tillage and mulching practices

Treatments	Tillage			Mean
	Cultivator 4 times	MB plow followed by Rotavator	Cultivator twice	
Wheat mulch	27.500	12.500	36.500	25.50 c
Barseem mulch	30.000	15.750	39.000	28.25 b
No-mulch	34.00	22.250	43.000	33.08 a
Mean	30.50 b	16.83 c	39.50 a	

Weed Population (m^{-2})

Data revealed that there was significant ($p<0.05$) effect of tillage practices and mulching on the weed population under semi-arid environment (Table-2). The weed species infesting the experiment

were *Trianthema portulacestrum*, *Xanthium strumarium*, *Digitaria sanguinalis*, *Sorghum halepense*, *Cynodon dactylon, Digera arvensis*, *Amaranthus viridis* and *Cyperus rotundus*. The maximum weed population (39.50 m^{-2}) was recorded by using cultivator twice while minimum weed population (16.83 m^{-2}) was recorded in mould board plow followed by using rotavator (Table-2). Similarly maximum weed population (33.08 m^{-2}) was recorded in treatments having no-mulch while minimum weed population (25.50 m^{-2}) was recorded in wheat mulch (Table-2). The interactive effect of tillage and mulch (T×M) on weed population was found significant (Table-2). The variability in weed population in different treatments can be attributed to the fact that pre-emergence herbicides are more effective for weeds control as compared to other traditional methods by Orkwor *et al.* (1983).

Residues on the soil surface basically improve moisture conservation and soil tilth (Locke and Bryson, 1997). In additions, the residues can effect weeds germination and emergence of the seed during this stage. The residues of wheat and barseem on the soil surface reduce total weed p0pulation by more than 75% compared with control treatments (Mohler and Teasdale, 1993). In another research a rye, wheat and barseem mulch in maize crop significantly decreased weed emergence of *C. album, D. sangunalis,* and *Partuaca oleracea* L. (Mohler and Calloway, 1992).

Overall germination of different weed species can be reduced in the presence of crop residues (wheat and barseem) on the soil surface, however a higher quantity than normally found in dry land field is requires to suppress weed germination and their growth (Chauhan and Johnson, 2010; Chauhan *et al*., 2006). Mulching basically increases crop growth and development, improve earliness (pore spaces) and yield of maize, used to control weed growth and reduce the incidence of plant diseases as compared to no-mulching by Elmer (2000) and Revathy (2003).

Similarly, on the other hand tillage practices have been used to control weeds since the beginning of agricultural system however, a reduction in tillage may dramatically increase weeds growth and development. Several studies suggested a small difference in weed population between conventional and zero tilled fields (Derksen *et al.*, 1993) and in some cases, fewer weeds were observed in zero till condition (Hobbs and Gupta, 2001; Sing *et al*., 2001). So this result clearly showed that both tillage and mulching practices reduces weed density, growth and development during semi-arid environment.

Harvest Index (%)

Harvest index was significantly affected by tillage treatments and mulching practices under semi-arid environment. Statistical analysis of the data revealed that maximum harvest index (22.71 %)

was exhibited by cultivator twice which progressively decreased to the minimum (21.12 %) in mould board plow followed by rotavatorduring crop life cycle (Table-3). Similarly the Harvest index was decreased significantly by increasing mulch levels (Table-3), maximum harvest index was observed in wheat mulch (22.20 %), followed by barseemt mulch (22.15 %) and minimum in control (22.04 %).The interaction of tillage and mulching (T×M) also found significant in case of harvest index (Table 3). Treatment means averaged over this crop also showed significant differences for harvest index.

Table-3. Harvest index as affected by tillage and mulching practices

Treatments	Tillage			Mean
	Cultivator 4 times	MB plow + Rotavator	Cultivator twice	
Wheat mulch	22.375	21.320	22.918	22.20
Barseem mulch	22.453	21.170	22.855	22.15
No-mulch	22.902	20.870	22.358	22.04
Mean	22.57 a	21.12 b	22.71 a	

Comparison of data of this crop exhibited significant differences. Harvest index depends upon the values of grain yield and biological yield. Higher values of grain yield and comparatively lower value of biological yield was resulted in higher harvest index and vice versa. Significant differences (Table-3) between harvest index values of the treatments showed that biological and grain yield were both affected in similar fields due to tillage and mulching practices.

The harvest index of cereals crops depends on grain yield (Bhatia, 1975) and biological yield. The harvest index of wheat and barseem straw treated plants increased possibly as consequences of their higher grain yield and biological yield. Grain yield increased was significantly correlated with harvest index. Increased harvest index resulted from increased crop yield was may be of improved portioning of dry matter to the cob as stated by Planiappan (1985).

CONCLUSION

From the results it was concluded that both tillage and mulching practices positively influenced weed population (m^{-2}), harvest index under semi-arid environment, but showingno significant effect on number of cob $plant^{-1}$ and days to emergence. In treatments combinations wheat straw mulch along with mould board plough followed by rotavator was proved superior in increasing yield and yield components of maize while no significant effect on both number of cob $plant^{-1}$ and days to emergence. Hence, it was recommended to use

wheat straw mulch in combination with mould board plough followed by rotavator for better maize yield and soil related parameters.

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