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# MULCHING: A MANAGEMENT PRACTICE FOR WEEDS IN MAIZE

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## ABSTRACT

A field experiment was conducted to determine the effect of different mulching treatments on weeds in maize. The experiment was done at the New Developmental Farm, University of Agriculture Peshawar during summer in 2011. A local maize variety "(Azam)" was sown in Randomized Complete Block Design having seven treatments (farmyard manure, chicken manure, black plastic, white plastic, hand weeding, chopped eucalyptus and weedy check). Data were recorded for weed density ($m^{-2}$), relative weed density (%), 1000 kernel weight (g), number of kernel $ear^{-1}$ and grain yield (kg $ha^{-1}$). Data analysis revealed that the maximum grain yield (5465 kg $ha^{-1}$) was recorded for hand weeding treatment and for black plastic treatment (4811.6 kg $ha^{-1}$) and white plastic (4146.4 kg $ha^{-1}$), while the minimum grain yield was recorded for weedy check (2498 kg $ha^{-1}$). Weedy check resulted in highest weed density (239.50 $m^{-2}$) followed by eucalyptus (165 $m^{-2}$) and chicken manure (132.70 $m^{-2}$) while the lowest weed density (51.83 $m^{-2}$) were recorded for hand weeding. The maximum relative weed density (RWD) was recorded for *Cyperus rotundus* L. (45.21%) followed by *Echinochloa crus-galli* L. (31.60), while the minimum RWD for *Convolvulus arvensis* L. (1.71). Maximum 1000-kerenal weight (296.67 g) was recorded for hand weeding followed by the black plastic (275.33 g), while the minimum 1000-kerenal weight (194.33 g) for weedy check. Maximum number of kernel $ear^{-1}$ (385.03) was recorded for hand weeding treatment followed by the black plastic (360.13) and for the white plastic treatment (336.7). However, the minimum number of kernel $ear^{-1}$ (212.87) was recorded for weedy check. In conclusion the results indicated that after hand weeding, black plastic controlled weed and increased yield in better way as compared to other treatments. Thus in small maize fields plastic mulch is recommended to be used for achieving best results.

**Key words:** Maize, weeds, mulch, losses and, grain yield

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**INTRODUCTION**

Maize (*Zea mays* L.) belongs to Poaceae and is grown in both spring and summer seasons in Pakistan. It is among the high yielding crops and has great economic importance for the developing countries like Pakistan where human population is continuously increasing. In Pakistan, maize is the third important cereal crop after wheat and rice (PARC, 2007). The area under maize cultivation in Pakistan and Khyber Pakhtunkhwa Province was 935.1 K and 421.9 K ha, respectively with production of 3261.5 K tonnes and 752.2 K tonnes and the average grain yields of 3488 and 1135 kg $ha^{-1}$ in Pakistan and Khyber Pakhtunkhwa, respectively (MINFAL, 2010). Khyber Pakhtunkhwa and Punjab contributes 68% and 30% of the total production, while Sindh and Balochistan contributes a very a small percentage i.e. 2-3% (Anonymous, 2010). Maize crop is planted more than 500,000 ha land area in high mountain and plains of Khyber Pakhtunkhwa but its production is much lower in these areas (Rahman *et al.,* 2012). Maize grains have great economic importance and are used for food, fodder, pharmaceutical and industrial purposes. Its grains contain starch, protein, fiber, oil and ash (Ahmad *et al*., 2007).

The main factors which are involved in low crop yield are the poor seed quality, shortage of irrigation water, high cost of various inputs, low standard farm mechanization, fertilizers shortage or its high prices, the use conventional sowing methods and the application of poor weed management practices (Jabeen and Moinuddin, 2009).

One of the most important threats for the maize crop production is the weeds as they compete with the crop plants for sunlight, moisture and nutrients (Anderson, 1996). Weeds not only lowering the crop yield, but also have an effect on the grain quality. Some of the major weeds found in maize crop in Pakistan are *Cyperus rotundus* L. (Purple nutsedge)*, Trianthema portulacastrum* L. (Horse Purslane)*, Sorghum halepense* (L.) Pers. (Johnson grass)*, Echinochloa colonum* (L.) Link. (Barnyard grass)*, Digera arvensis* Forsk. (False amaranth)*, Cynodon dactylon* (L.) Pers. (Bermuda grass) (Riaz *et al.,* 2004). The most important threat in maize production is weed (Karimmojeni *et al*., 2010). Despite using various weed control methods, the yield losses due to weeds are still 12.8% (Oerke and Steiner, 1996) and the losses may increase upto 70% (Teasdale, 1995). Therefore, the most effective weed management has a great value to increase maize crop production in Khyber Pakhtunkhwa. Though the application of herbicides is one of the cheap and quicker weed control methods yet this method has some negative effects on the surrounding environment, human health and on the domesticated and wild animals health (Robinson, 2009). Thus to avoid the incidences of these non-desirable effects, environment friendly weed

control methods are required to be used for weed management in maize crop. Mulching is among one such weed management method. Mulch is a material that covers the soil surface to protect and to improve the covered land area. Mulch is of two types (organic mulch; living and inorganic mulch; non-living). Organic mulch includes plant leaves, barks, woodchips, grass clipping all of which can retain the nutrients found in these organic matters. Inorganic material includes polyethylene sheaths, pebbles and gravels. Mulching is an effective method to be used for the control of weeds (Kluepfel, 2010).

Keeping in view the losses caused by weeds to the maize crop, an experiment was designed to select best possible mulch. This could reduce the maize production losses by minimizing weed infestation and hence will increase yield.

## MATERIALS AND METHODS

A field experiment was conducted at New Developmental Farm, The University of Agriculture Peshawar-Pakistan. The experiment was laid out in Randomize Complete Block Design (RCBD) with 3 replications. Each replication consists of 7 treatments. Each treatments consists of 6 rows with row to row distance of 0.75 meter, plant to plant distance 2 meter and each plot measured 4 × 4.5 $m^2$. The treatments in this study were farmyard manure, chicken manure, black plastic, white plastic, hand weeding, Eucalyptus (Fresh leaves were collected from Agriculture research farm and then chopped) and weedy check. The seed of local maize variety (Azam) was sown in June, 2011 with the help of dibbler and then thinned at three weeks after emergence to adjust the recommended plants population per hectare. All of treatments were applied after five days of the crop emergence. Hand weeding was done twice using hand hoe for the hand weeding treatment. The crop was irrigated according to its requirements. The recommended dose of nitrogen and phosphorus 150 kg $ha^{-1}$ and 60 kg $ha^{-1}$ respectively, was applied in the form of urea and DAP (Saeed *et al.*, 2010). The attack of borer pest was control by Chlorpyrifos 40% EC at the rate of 1.5 L $ha^{-1}$ at four weeks after planting. The data were recorded for the different treatments weed density, relative weed density, number of ears $plant^{-1}$, 1000 kernel weight (g), number of kernels $ear^{-1}$ and the grain yield (kg $ha^{-1}$).

## RESULTS AND DISCUSSION

**Weed density $m^{-2}$:** The statistical analysis of the data showed that different mulching treatments had significant effect upon the weed density $m^{-2}$ (Table-1). The highest weed density (239.50 $m^{-2}$) was recorded for the weedy check followed by Eucalyptus (165 $m^{-2}$) and chicken manure (132.70 $m^{-2}$) mulches. The lowest weed density

(51.83 $m^{-2}$) was recorded for hand weeding and was statistically at par with black plastic (65.73 $m^2$) and white plastic (71.40 $m^{-2}$). The variable weeds density among the various weed control treatments can be attributed to their variable weed control efficacy. Aslam *et al*. (2007) have reported that hand weeding could achieve upto 79% weed control. Similar results have been reported by Ali *et al*., (2011) that application of organic mulches might decrease weed density.

**Table-1.** Effect of different mulching practices on some agronomic traits of maize.

| Treatments | Weed density ($m^{-2}$) | 1000-kernel weight (g) | Number of kernel $ear^{-1}$ | Grain yield (kg $ha^{-1}$) |
|---|---|---|---|---|
| Farmyard manure | 107.33 d | 248.67 cd | 329.40 c | 3958.3 cd |
| Chicken manure | 132.70 c | 236.00 cd | 320.03 c | 3541.3 de |
| Black plastic | 65.73 e | 275.33 ab | 360.13 ab | 4811.6 b |
| White plastic | 71.40 e | 250.67 bc | 336.70 bc | 4146.4 c |
| Hand weeding | 51.83 e | 296.67 a | 385.03 a | 5465.0 a |
| Eucalyptus (chopped) | 165.00 b | 224.00 d | 282.00 d | 3275.2 e |
| Weedy check | 239.50 a | 194.33 e | 212.87 e | 2498.0 f |
| LSD | 30.772 | 25.515 | 69.554 | 418.45 |

Means of the same category followed by different letters are significantly different at P≤0.05 level using LSD test.

**Table-2.** Effect of different mulching practices on relative weed density (%).

| **Weed species** | **Relative weed density (%)** |
|---|---|
| *Cyperus rotundus* L. | 45.21 |
| *Echinochloa crus-galli* (L.) | 31.60 |
| *Digera arvensis* Forsk. | 9.82 |
| *Dactyloctenium aegyptium* (L.) | 8.88 |
| *Euphorbia prostrata* Aiton. | 8.01 |
| *Convolvulus arvensis* L. | 1.71 |

**Relative weed density (%)**

The data on relative weed density of weed species is shown in Table-2. The present study showed that the field was mostly dominated by *Cyperus rotundus* L. (Purple nutsedge), *Echinochloa crus-galli* (L.) Beauv. (Common barnyard grass), *Digera arvensis* Forsk. (False amaranth), *Dactyloctenium aegyptium* (L.) Willd. (Crowfoot grass), *Euphorbia prostrata* Aiton. (Prostate sandmat)

*Convolvulus arvensis* L. (Field bindweed). The maximum relative weed density (45.21 %) was recorded for *Cyperus rotundus* L. followed by *Echinochloa crus-galli* (L.) Beauv. (31.60 %) while minimum relative weed density recorded for *Convolvulus arvensis L*. (1.71 %). These results are in great uniformity with the work reported by Muhammad *et al.* (2009).

**1000 kernel weight (g)**

The results of the present study showed that different mulching treatments had significant effect on 1000-kernal weight. Table-1 revealed that maximum 1000-kernal weight (296.67 g) was recorded in those plots where hand weeding was done and was statistically at par with black plastic (275.33 g) while the minimum 1000-kernel weight were recorded in weedy check plots (194.33 g). The higher 1000-kernel weight in hand weeded and black plastic plots might be due higher dry matter accommodation and higher resources availability. However, in weedy check plots the less 1000-kernel weight might be due to improper nutrients availability and heavy weed infestation. These results for the mulches effect are in line with the findings of Kwabiah (2004) who stated that plastic mulch increased grains weight. Hussein (1997) also reported that decreased in grains weight was directly proportional to duration of weed competition.

**Kernel production**

Data regarding number of kernel ear$^{-1}$ showed that different mulching treatments had significant effect on number of kernel ear$^{-1}$ (Table-1). The data showed that maximum number of kernels ear$^{-1}$ were recorded in hand weeded plots (385.03) which was statistically similar to black plastic (360.13). The minimum number of kernel ear$^{-1}$ was recorded in weedy check plots (212.87). The greater number of kernels ear$^{-1}$ might be due to less weed competition, which made all the resources available to plants resulted in greater no of kernel cob$^{-1}$. These results are in line with the work of Kwabiah (2003) and Kwabiah (2004) who investigated that plastic mulch increased number of grains cob$^{-1}$. Similar result of different mulches on weed flora and yield of maize has been reported by khan *et al*. (2011).

**Grain yield (kg ha$^{-1}$)**

Analysis of the data showed that different mulching treatments significantly affected grain yield of maize (Table-1). The results showed that maximum grain yield (5465 kg ha$^{-1}$) was obtained from those plots in which hand weeding was done. It was followed by black plastic producing grain yield of (4811.6 kg ha$^{-1}$) and white plastic (4146.4 kg ha$^{-1}$), while minimum grain yield was recorded in weedy check (2498 kg ha$^{-1}$). As we know from the literature that weed causes 20-40% losses in grain yield, thus the maximum grain yield in hand weeded and black plastic mulching plots might be due to low

weed competition and more nutrients availability while in weedy check low grain yield was could be due to more weed competition. Zafar *et al*. (1981) reported that hand weeding significantly increased grain yield. Similarly, Khajanji *et al.*, (2002) obtained higher grain yield with twice hand weeding. Plastic mulch improved maize grain yield (Yonghe, 1994). These results for the mulches effect are in line with those of Maurya and Lal, (1981) who reported that black plastic yielded more than un-mulched treatments.

## CONCLUSION

The results indicated that the application of different mulches had a negative effect upon the weed density and a positive effect on the maize crop growth and grain yield. Hand weeding could be one of the most effective method for weed control in maize. However, in areas where plenty and cheaper man power is not available then use of plastic mulches may be useful weed control approach in small maize fields. Farmyard manure and chicken manure can also be a good option but subjected to their availability. In conclusion, all the tested mulches controlled weeds however; the selection of mulch depends upon the feasibility and availability of mulch material in different areas.

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