**Impacts of herbicide and tillage techniques on soil properties and wheat growth in cotton-based cropping system**

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**Abstract**

A field test was exercised at ARI, Ratta Kulachi, DIK, Pakistan to appraise the effect of many weedicides and cultivation systems on soil physiognomies & wheat growth. Test was placed out in RCBD with split-plot arrangement. Zero tillage, Reduced tillage and Conventional tillage be located to main plots, whereas weed control treatments to the sub-plots. The weeds control treatments were Buctril Super 40 EC (Bromoxynil + MCPA) @ 500 ml acre-1, Topik 15 WP (Clodinafoppropargyl) @ 120 g acre-1, Buctril Super 40 EC + Topik 15 WP, Hand hoeing and weedy checked. The herbicides and tillage were meaningfully affected organic and grain yield. The highest biological (14295 kg ha-1), grain yield (5846 kg ha-1) and HI (40.9 kg ha-1) noted in CT amongst the other tillage system. Likewise, combination of Buctril Super (bromoxynil) + Topik produced highest biological (17233 kg ha-1), grain yield (6957 kg ha-1) and HI (40.5 kg ha-1). In tillage and herbicide communication highest Biological Yield was attained with Buctril Super (bromoxynil) + Topik under RT. Grain yield was topmost with mixture of Buctril Super (bromoxynil) + Topik under CT, while Harvest Index was highest with hoeing under CT. Concerning soil characteristics, there was no considerable change except soil O.m, soil pH and total soil nitrogen which were rather reduced at the end of test. The results assess that broad spectrum herbicides i.e Buctril Super (bromoxynil) + Topik in condition with conventional tillage were more efficient in controlling weeds and producing higher wheat yield.

**Keyword:** tillage, herbicide, weed, wheat

**Introduction**

Wheat (*Triticum aestivum* L.) is a major food crop of Pakistan and meets the nutritional requirement (Farooq et al., 2014). It covers almost 21% global food requirement and cultivated on >200 million hectares, worldwide (FAO, 2010). In 2015-2016, In Pakistan 25.48 million tons wheat were obtained from 9.26 million hectares which contributed 2.2 % in GDP (GOP, 2016). A (production of wheat in Pakistan has still lower than other countries yet the varities has been developed progressively. Harvest decline features include sowing time, virus, insect and weeds. In many ways the weeds can harmfully affected the crop production. For light, moisture, nutrients and space, Weeds can contest with crop plants and also rise harvesting costs, reduce quality and yield of crops (Arnon, 1972). the organization of wildflowers is significant for cumulative wheat yield (Khan *et al.* 2003).

For producing good grain yield, biochemical weed controle was best than hand hoeing. Akhtar *et al*. (1991) found that (GY and Yield constituent were definitely affected with the use of grassy and broad leaf herbicides. So for that purpose the research was planned to educate the result of various weedicides and tillage for real control of weeds in wheat.

The soil was adversely affected by the use of unnecessary tillage operations. Therefore, the minimum and ZT were used for controlling erosion, increasing WUE of kharif crops and its productivity (Buschiazzo *et al*. 1998). Adaptation of ZT has been found to reduce machinery, labour and fuel cost (Ribera et al., 2004). ZT is very useful as it reduces soil erosion and also stops the release of greenhouse gases from earth (Khan *et al.,* 2005). Chaudhary *et al*. (1992) comparing CT system to ZT decided that higher wetness holding and 13% more revenue was got in case of ZT. ZT / RT skill which is a vital constituent of upkeep agriculture, widely encounters the necessity of the above-mentioned problem such as, early sowing, reduced input & improves output. (Khan *et al*.2004). In ZT skill, seed is sown into fallow soil by opening a narrow slit, ditch of enough width and depth of seed coverage. A minimum tillage is practices in RT, which is useful for sowing crops as well as the earth remain undisturbed, while cotton stubble remains intact in ZT technology. The microbial activities in soil has enhanced, which increase the efficiency of fertilizer, as well as stubble decay process is accelerated through ZT or RT). (Usman *et al.* 2010).

Wild plant contest with crop for water, nutrient and space. Weeds not only reduce the yield of the crop but also reduce the quality of produce by contaminating the seed. Mann *et al.* (2004) observed effective weed control with herbicides in zero tillage Khan *et al.* (2002) noticed significant chemical weed control in conventional tillage and obtained increased yield. It is therefore; imperative to determine result of weedicide and tillage on weed thickness and wheat harvest and soil properties in cotton based cropping system. (Rhoton, 2000). CT rise the risk of runoff and soil erosion and interrupts soil structure and also affect soil temperature. (Dwyer *et al.* 1996), The physical properties are utmost importance for crop production have a permanent nature, affected by use of tillage system and usually difficult to change, as compared to soil chemical properties. By untying and decrease bulk density the tillage increases the soil porosity (Pidgeon and Some, 1978; Rizvi *et al*. 1987). The objective of this test is to liken the result of dissimilar herbicides and tillage systems to maximize the wheat yield.

**Materials and methods**

Field test was carried out at ARI, Ratta Kulachi, DIK, Pakistan during 2010-2011. The test was arranged in a RCB design with split-plot plan. Detail of conducts and trial procedure is following.

Before land preparation roni irrigation was done. On medium soil moisture, the land was prepared with the help of 3-4 ploughing, 2-3 planking and rotavator. Though, in case of ZT wheat was sown directly into previous crop stubble by drill.

In the main plots ZT, RT and CT were kept, while herbicide treatments viz (1) Buctril Super 40 EC @ 500 ml Acre-1 (2) Topik @ 120 g acre-1 (3) Buctril Super + Topik (mixture) @ 500 ml + 120 g acre-1 (4) Hoeing (5) Control were allocated to subplots. Replicated 4 times.

After the harvesting of cotton, Wheat (CV. Hashim-8) was sown in rows on 20 Nov 2010 by drill method. Fertilizer was used @ 150: 120: 90 NPK kg ha-1. All P2O5, K and partial N was used at sowing time and rest of nitrogen was applied with 1st irrigation. All the organization does comprise: irrigation, hoeing, weeding etc. throughout growing season. Herbicides were sprayed after the emergence of weeds at proper moisture condition. The crop was picked on 1st week of April.

**Treatment detail**

In the main plots, Zero tillage, Reduced tillage and Conventional tillage were applied, while in subplots different doses of herbicides were applied (H1= Control, H2= Buctril Super 40 EC @ 500 ml acre-1 H3= Topik 15 WP @ 120 g acre-1, H4= Buctril Sup + Topik (mixture), H5= Hand weeding).

**Results and discussion**

Average values for tillage presented that CT produced uppermost biomass yield (14295 kg ha-1) among the tillage systems. ZT showed lowermost Biological yield (12258 kg ha-1). Average values for herbicide indicated that H4 produced uppermost BY (17233 kg ha-1) while H1 gave lowermost BY (10224 kg ha-1). In tillage and herbicide (T x H) interaction H4 gave highest biological yield (18590 kg ha-1) in reduced tillage (RT) while control (H1) showed lowest biological yield (8166 kg ha-1) in zero tillage (ZT). The highest biological yield with herbicide H4 in conventional tillage (CT) may be due to efficient weed control which resulted in highest biological yield. My findings are in agreement with that of khan *et al.* 2003. Interactive effect of tillage practices and herbicide on biological yield is presented in Fig. 1.

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**Fig. 1.** Interactive effect of tillage practices and herbicide on biological yield

**Grain yield**

Grain yield was meaningfully affected by tillage, herbicide and interaction. Average values for tillage showed that CT produced highest GY (5846 kg ha-1) among the tillage systems. ZT presented lowermost grain yield (3670 kg ha-1). Average values for herbicide showed that H4 produced uppermost grain yield (6957 kg ha-1) while control (H1) gave lowermost grain yield (2347 kg ha-1). In tillage and herbicide interaction H4 gave peak grain yield (7381 kg ha-1) in CT while control showed lowest grain yield (1318.2 kg ha-1) in ZT. The uppermost grain yield was detected with weedicide H4 in CT. The results are contract with that of khan *et al.* 2003. Interactive effect of tillage practices and herbicide on biological yield is presented in Fig. 2.

**Fig. 2.** Interactive effect of tillage practices and herbicide on grain yield

**Harvest index (H.I.)**

Harvest index was considerably affected by tillage (T), herbicide (H) and interaction (T x H). Mean values for tillage revealed that conventional tillage produced highest harvest index (40.9 %) among the tillage systems. ZT showed lowest HI (28.9 %). Mean values for herbicide showed that H4 produced highest harvest index (40.5 %) while H1 gave lowest HI(22.7 %). In tillage and herbicide interaction H5 gave highest HI (51.4 %) in CT while control (H1) showed lowest harvest index (16.4 %) in zero tillage (ZT). The highest harvest index with herbicide H5 in hand weeding may be due to efficient weed control which resulted in highest harvest index shown in Table 4. The results are similar with Jarwat *et al.* 2005. Interactive effect of tillage practices and herbicide on yield index is presented in Fig. 3.

**Fig. 3.**  Interactive effect of tillage practices and herbicide on yield index

**Soil Analysis**

The soil analysis points out that O.m, total N, and zinc was decreased slightly, while pH & EC & the rest of soil properties remain same.

**Table 1.** Effect of zero tillage, reduced tillage and conventional tillage on soil properties after wheat harvest.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameters | Units | ZT | RT | CT | Mean |
| Clay | % | 47 | 47 | 47 | 47 |
| Silt | % | 41 | 41 | 41 | 41 |
| Sand | % | 12 | 12 | 12 | 12 |
| Organic matter | % | 0.87 | 0.86 | 0.85 | 0.86 |
| PH |  | 8.4 | 8.3 | 8.5 | 8.4 |
| EC | Dsm-1 | 2.54 | 2.53 | 2.55 | 2.54 |
| Available P2O5 | mg kg-1 | 7.3 | 7.8 | 7.5 | 7.54 |
| Available K2O | mg kg-1 | 163 | 161 | 160 | 161.34 |
| Saturation | % | 45 | 46 | 47 | 46 |
| CO3-1 | mg kg-1 | - | - | - | Nil |
| HCO3-1 | mg kg-1 | 8 | 7 | 9 | 8 |
| Cl-1 | mg kg-1 | 13.33 | 13.34 | 13.30 | 13.33 |
| Ca++ + Mg++ | mg kg-1 | 4.64 | 4.63 | 4.64 | 4.64 |
| Na+ | mg kg-1 | 12.43 | 12.40 | 12.41 | 12.42 |
| Total Nitrogen | % | 0.040 | 0.035 | 0.032 | 0.036 |
| Zn | mg kg-1 | 0.73 | 0.72 | 0.70 | 0.72 |
| Cu | mg kg-1 | 0.089 | 0.088 | 0.087 | 0.088 |
| Fe | mg kg-1 | 4.12 | 4.11 | 4.00 | 4.07 |
| Mn | mg kg-1 | 0.098 | 0.088 | 0.086 | .090 |
| Bulk density | mg kg-1 | 1.49 | 1.47 | 1.45 | 1.47 |
| Infiltration rate | mg kg-1 | 0.12 | 0.14 | 0.15 | 0.14 |

**Conclusion and recommendation**

Maximum BY (17233 kg ha-1), highest grain yield (6957.3 kg ha-1) & maximum HI (40 kg ha-1) was found in plot treated with weedicide Topik @ 120g acre-1 + Buctril Super @ 500-liter acre-1. Output of my research identified that the mixture of Topik + Buctril Super good combination in KPK for wheat production. no considerable changes were observed in respect of soil physico-chemical characteristics with tillage and weedicides use. because a short term (6 months) effects of ploughing and weedicides were insignificant. Though, there may be some effects of tillage and herbicides if applied for lengthier period.

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