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TILLAGE AND SEED RATES EFFECT ON WEED BIOMASS, GRAIN AND BIOLOGICAL YIELD OF DRYLAND CHICKPEA

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Abstract

A field experiment was conducted to evaluate the effect of conventional tillage (CT) or no Tillage (NT) systems using three seed rates (40, 80 and 120 kg ha^{-1}) of chickpea. Aim of the experiment was to develop management strategy for control of weeds and increase yield of chickpea under rainfed condition. The experiment was laid out in randomized complete block design with split plot arrangement having tillage system as main plot and seed rate as sub plot. CT was more effective in controlling weeds, enhancing grain and straw yields as compared with NT. Plots seeded @ 80 kg ha^{-1} though had higher weeds biomass and lower straw yield as compared with 120 kg ha^{-1} seed rate, its grain yield was significantly higher than both higher and lower seed rates used in the experiment. Seed rate of 80 kg ha^{-1} under CT seems to the promising combination for rainfed chickpea.

Introduction

Chickpea seeds are valued for its high protein content (22.5%) and play an important role in human nutrition. Lack of desirable moisture level, mineral nutrients deficiency and presence of noxious weed, suboptimal crop stand are the major factors responsible for low yield of chickpea in rainfed area. To deal with these problems selection of proper tillage system and suitable seed rate may become necessary.

Producing crops usually involves regular tilling referred as conventional tillage (CT), but is now criticized for having unfavorable effects on soil and ultimately on crop so no-tillage are preferred (Armstrong *et al*., 2003; Diaz-Zorita *et al*., 2004; Nelson & Vigil, 2005; Al-Kaisi & Kwaw-Mensah, 2007; Triplett & Dick, 2008; Yoo & Wander, 2008). However, certain crops, which do not tolerate the increased competition with weed in early life, are not suitable for no-till agriculture (Pandey *et al*., 2001; Anderson, 2003; Hassan *et al*., 2003).

Similarly, studies on seed rate for closely related and other crops are available (Tawaha & Turk, 2001; Hanna *et al*., 2008; Zewdu, 2008; Thomason *et al*., 2009) but no appropriate study is available for chickpea especially for its production in dry area. Farmers usually apply high seed rate to compensate for poor germination and suppress weeds and the findings are also used for the expected sparse germination and reducing weeds intensity in rainfed condition. Suppression of weeds by higher seed rates seems attractive but above optimum plant density may lead to higher competition between the plants for the already meager moisture. The present work was initiated to study the effect of tillage system and seed rates on chickpea production under dry land condition to find out and recommend proper tillage system for Peshawar and alike environmental condition.

Materials and Methods

Chickpea cultivar Hassan-2000 was sown at 65 % moisture after light irrigation in field kept under Conventional tillage (CT) or Zero Tillage systems at the New Developmental Farm of NWFP Agricultural University, Peshawar, Pakistan. The experiment was laid out in randomized complete block design with split plot arrangements. Tillage systems (CT and NT) were kept in main plots while the three seed rates (40, 80 and 120 kg ha^{-1}) were placed in subplot. Seed were sown in row to row distance of 30 cm, having six rows in subplot size of 1.8 m x 5 m on 4th November, 2004. The treatments were replicated four times. Nitrogen was applied @ 20 kg ha^{-1} as a basal dose. Crop was harvested at physiological maturity on 14.04.2005. Data were recorded on weeds biomass, straw and grain yield. Data on weeds biomass was recorded by harvesting the weeds within a meter row length at three spots in each sub plot at random. For recording straw, grain or biological yield four central rows were harvested, sun dried and threshed and the data was converted into yield kg ha^{-1}.

Data recorded were statistically analyzed using analysis of variance appropriate for randomized complete block design with split plot arrangement.

Results and Discussion

The results revealed significant effect on weed biomass, and straw, biological and grain yields. Fig. 1 shows that CT had significantly less weed biomass as compared with NT. The lower weed biomass in CT is certainly the result of number of tillage operations that destroyed weeds. The finding are in agreement with Kettler *et al*., (2000) as they have reported lower weed biomass in CT compared to NT system. Grain yield (1771 hg ha^{-1}) and straw yield (3471 kg ha^{-1}) were significantly higher in CT compared to NT (Figs. 2-3) where grain and straw yield were 1732 and 2444 kg ha^{-1} respectively, confirming the beneficial effect of CT in the present study.

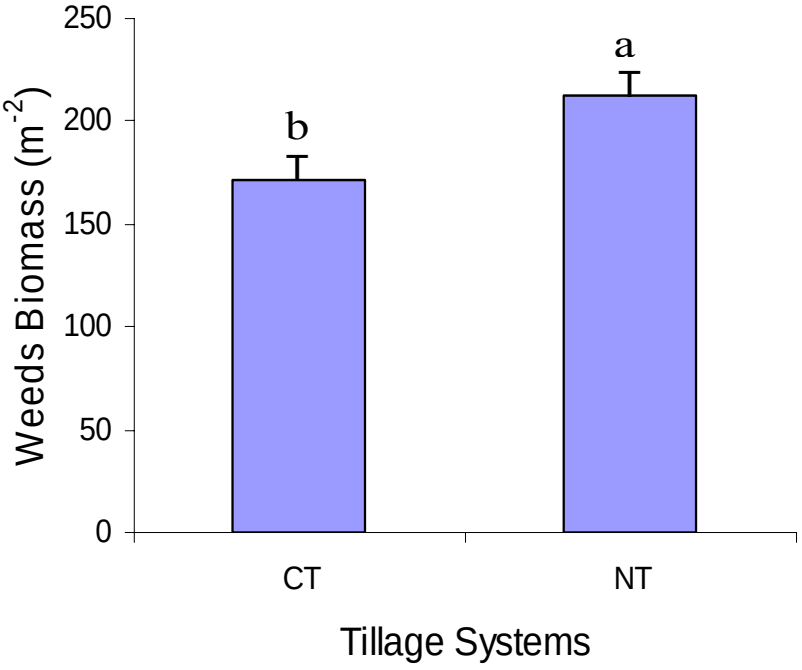

Fig. 1. Effect of tillage systems on weeds biomass of rainfed chickpea.

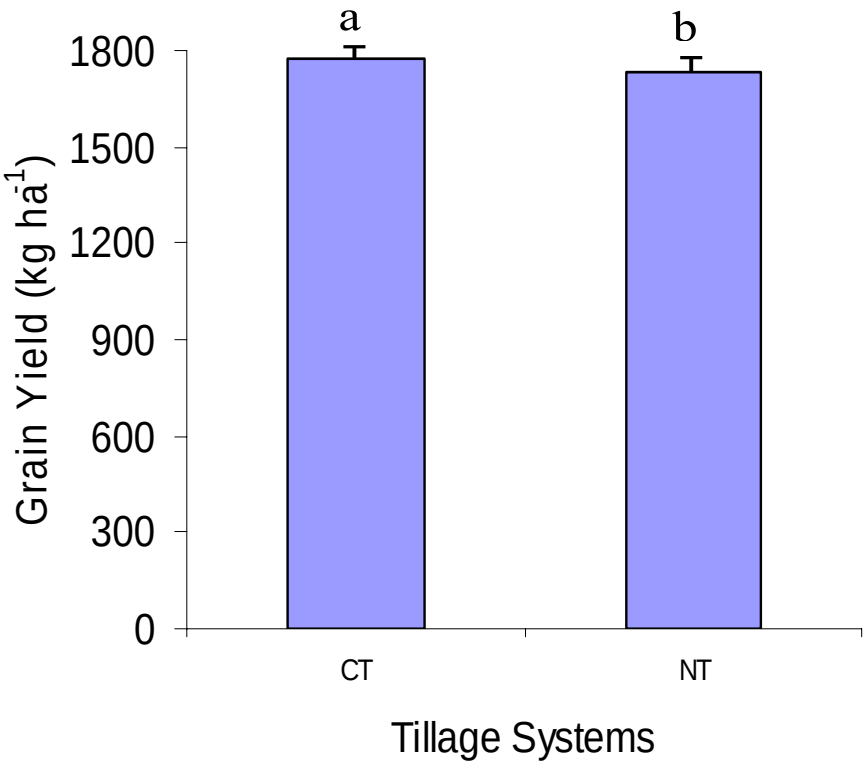

Fig. 2. Effect of tillage systems on grain yield of rainfed chickpea.

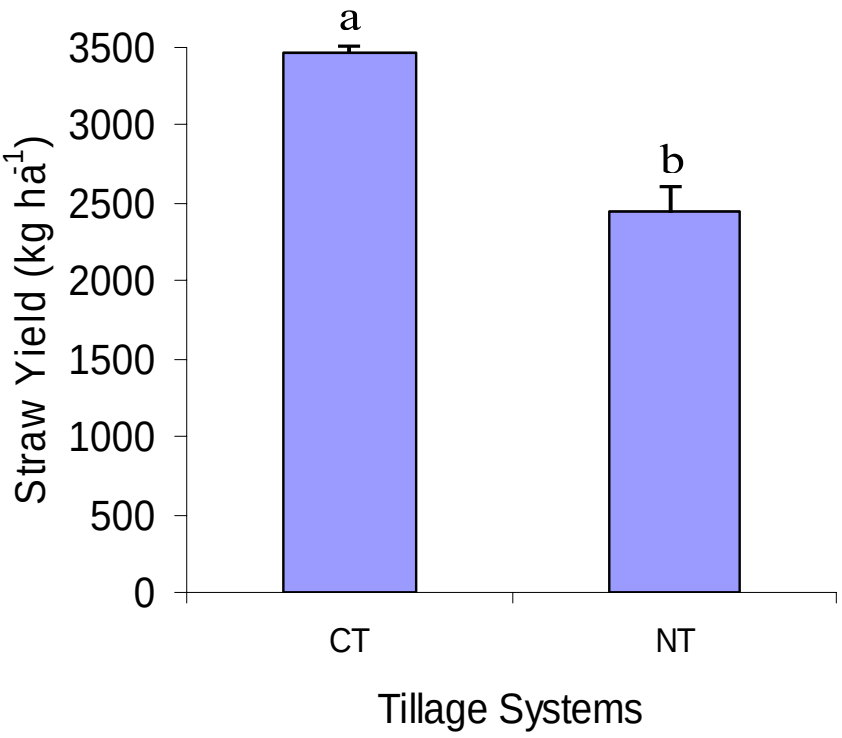

Fig. 3. Effect of tillage systems on straw yield of rainfed chickpea.

The relationships between seed rate and weeds biomass, grain yield and straw yield is presented in Figs. 4-7. Figure 4 shows that weeds biomass decreased with increase in seed rates in both the tillage systems. Grain yield increased with increase in seed rate from 40 to 80 kg ha^{-1} in both the tillage systems while beyond 80 kg ha^{-1} grain yield decreased (Fig. 5) indicating the negative impact of increased population on grain yield. Comparing tillage systems effect it is evident from the Fig. 5 that more yield was

recorded in CT system at the similar seed rate (80 kg ha^{-1}). Straw yield increased with increase in seed rate due to more biological yield as shown in Fig. 6. Also, in the same figure tillage systems has indicated visible difference that reasoned to more plant per unit area in CT established due to favorable conditions for germination and emergence. The relationship between biological yield and grain yield is presented in Figure 7 which showed that with increase in biological yield grain yield has quadratic relations that are supported by the findings of Daur *et al*., (2008).

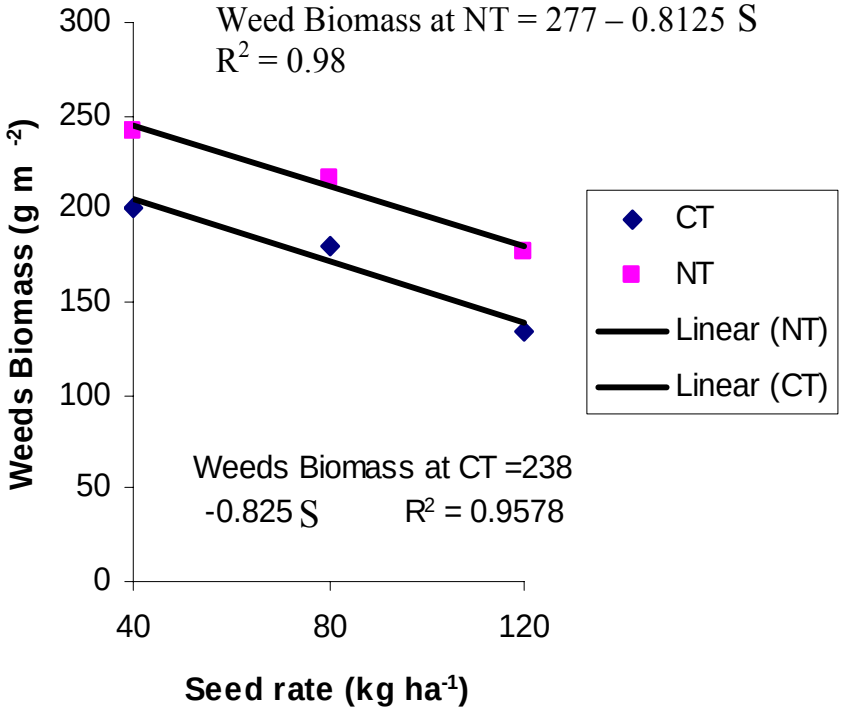

Fig. 4. Effect of tillage systems and seed rate on weeds biomass of rainfed chickpea.

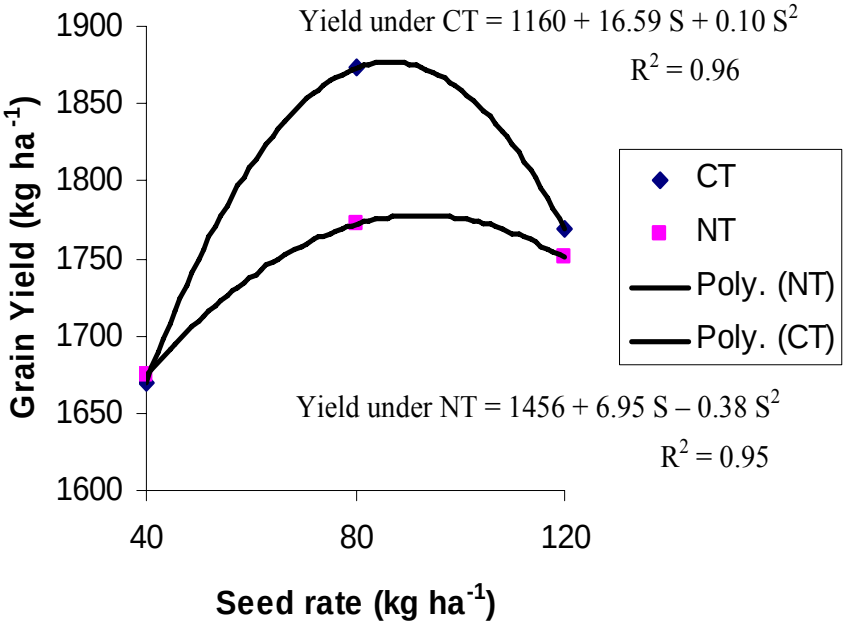

Fig. 5. Effect of tillage systems and seed rates on grain yield of rainfed chickpea.

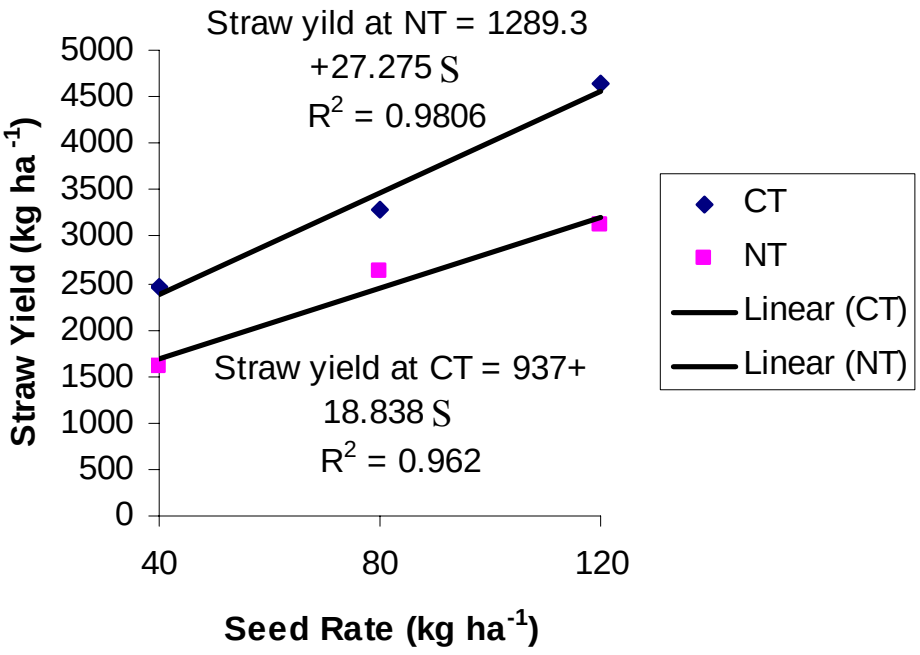

Fig. 6. Effect of tillage systems and seed rate on straw yield of rainfed chickpea.

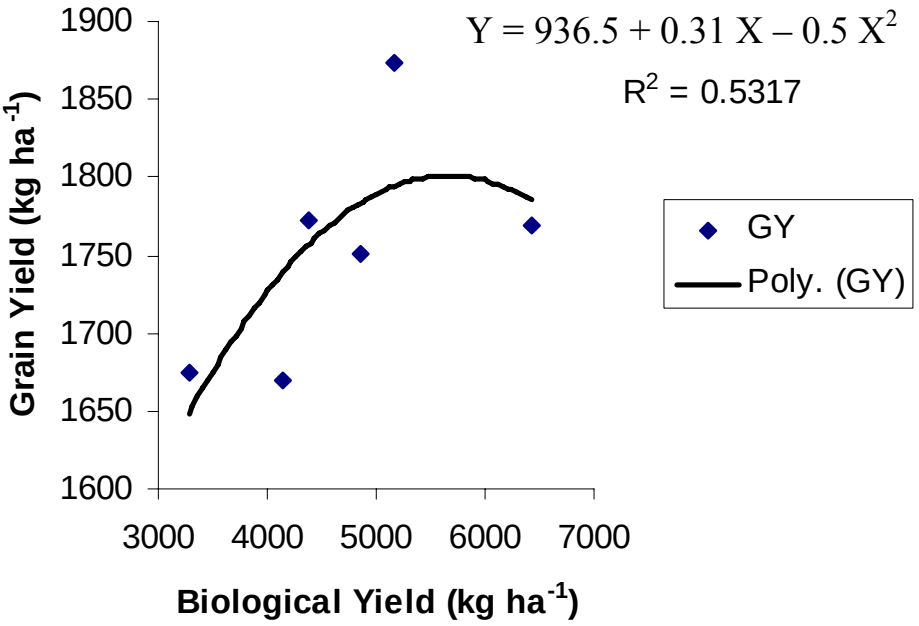

Fig. 7. Relationship between grain yield and biological yield of rainfed chickpea under different tillage systems.

Conclusions and Recommendations

It can be concluded from the present findings that CT was more beneficial in term of weeds control, yield affecting parameters and yield as compared with NT. Increase in seed rates brought about reduction in weeds biomass but more than 80 kg ha^{-1} seems to be not feasible as it has negative impact on grain yield of Chickpea under the prevailing condition for growth. On the basis of present experiment CT and 80 kg ha^{-1} seed rate are recommended for rainfed condition.

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