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Research Article

The Effect of Surface Non-Inversion Tillage Compared to Deep Inversion Tillage, on Weed Dry of Wheat and Chickpea

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Abstract

Effect of different tillage methods on weed dry weight of wheat and chickpea in rainfall areas where weeds are the main problem. To overcome this problem a field experiment was arranged at Islamic Azad university Farm Tehran Research Sciences (Iran). In this field experiment, different tillage and cropping systems were used. Tillage systems which were used include (I) Deep Inversion Tillage method (moldboard + two secondary tillage with a disk) Non Inversion Tillage Methods With (II) tillage with Chisel plow alone (III) Chisel plow+ Single Basket Roller (IV) Chisel plow + With double finger roller. Two cropping systems were also used during this experiment which was wheat–chickpea-Data on weeds dry weight was recorded after 50-60 days of crops grown during the study. The results of this study showed that there is a significant difference between different tillage methods of weed control in terms of dry weight weeds. For both years of research by implementing surface tillage accompanied by chemical and mechanical methods of weeding, we reduce the dry weeds in the long run.

Keywords: Non-Inversion; Deep Inversion; Dry Weight

Introduction

Weed management involves the accurate recognition of many environmental parameters, such as the use of tillage methods. The development of non-Inversion tillage without the use of herbicides and the proper technology can never be achieved. On the non-Inversion tillage systems, herbicides are part of the continuous tillage system, whereas, in deep inversion tillage methods, herbicides are complementary to the effects of soil tillage operations. By changing the system of no-tillage systems and minimum tillage, the problem of weeds and unwanted plants increased and as a result, plant growth is affected. Both of these factors can increase the dry weight of weeds in the absence of adequate control, in particular, the non-use of herbicides. Information on weed management in conservation crop production systems is needed as adoption of practices such as tillage method and cover crops become more widespread. Changes in patterns of tillage, planting systems, and other management strategies can alter the soil environment and lead to shifts in weed populations. Weed patterns and populations are not always consistent and vary with locale, crop, and herbicide use. However, in many long-term tillage management studies, a general increase in perennial weeds and grass species has been observed. The development of low-dose herbicides, selective postemergence herbicides has greatly improved the flexibility of producers who use conservation systems where opportunities for tillage are limited. With a higher level of management inputs, producers can successfully implement conservation management practices [1]. Soil tillage has an effect on the dynamic distribution of seeds in both vertical and horizontal conditions, which in reduce tillage distributes weed seeds in upper layers of soil [2]. When the residue of the previous product is distributed uniformly and dense on

the surface of the soil they can delay germination of weed seeds so the seeds have the opportunity to compete with the weeds Residue management and tillage at the right time can be largely controlled weeds [3]. The type of soil tillage method has a great effect on the dry weight of seeds of different species of weeds in the depth of the soil. Therefore, in reduced tillage, seed distribution was superficial [4]. Tillage method has significant influence on nature and growth of weed species. Weed management under non Inversion tillage is a greater challenge than in deep Inversion tillage, because there is no weed seed burial by tillage operations, and soil-applied herbicides are not incorporated, resulting in reduced efficacy. A large proportion of weed seed bank remains generally on or close to the soil surface after sowing under non Inversion tillage. Perennial weeds may also become more challenging in this system, where deep Inversion tillage is absent [5]. Fighting weed species are done in combination with mechanical and chemical methods. The type of method and the number of tillage operations is one of the factors that can reduce weeds. To reduce tillage methods, using herbicide previous to soil tillage, we can control the species of weed leaf that grow in minimum soil tillage methods [6]. The tillage operations were not just for preparing seed beds, because of the factor affecting the vertical and horizontal distribution of seed in the weed bank was soil different layers of soil in the qualification of Available humidity and fluctuations in the temperature of the board are different, Therefore, determination of soil depth and intensity of soil was one of the most important factors in soil tillage. In qualification of weed seeds distribution, we can observe significant differences between 0-05, 5-10,10-15 [7]. Tillage and cropping systems play a very crucial role in controlling weeds [8]. Perform some primary tillage operations with a moldboard plow and a chisel plow with components as are two parts have significantly reduced weed dry weight [9]. Under the influence of surface operations, a large part of the annual weed seed and some perennial weeds accumulate in the soil surface (depth of 0-2 cm), which germinate and explode during the next season and next year [10]. The research has shown that the effect of tillage on the amount of weed bank in the soil depends on the type of weed [11]. One of the methods of weed management is the use of mechanical methods to reduce weed germination. Tillage has a great impact on the vertical displacement of weed seeds [12-14]. As a result,the seed depth affects the soil profile and can affect seed germination of weeds [13,15]. The depth of placement of weed seeds in the upper layer of soil (80-100 mm) and them germinate also depends on the type of weed seed and its depth [13]. In the tillage method with moldboard, about 11% to 28% of the seeds are weed at a depth of 40 to 50 mm of soil [12,16,17].

Material and Methods

Description of Experimental Site and Climatic Variables

A field experiment was performed at an agricultural university research farm, Kermanshah (Iran) at longitude 45 degrees, 20 minutes and 39 seconds east to 48 degrees, 1 minute and 58 seconds east and latitude 33 degrees 37 minutes in relation the effect of different tillage methods (as the main factor) on weed dry weight of wheat (*Triticum aestivum* L) and chickpea (*Cicer arietnium* L) in tropical climates during the growing season of 2016 – 2017 with medium textured to clay-loam characteristics. Rainfall of this area ranges from 350mm to 500mm and soil moisture during the operation was 10-12% with %71 soil, plastic limit. The soil characteristics were described in table 1.

Place of research	EC (ds.m-)	PH	K(mg/kg)	P(ppm)	N (%)	Clay (%)	Silt (%)	Sand (%)	OC (%)
Kermanshah	0/1	7/8	800	0/1	0/136	35/76	56/18	68/45	1/36

Table 1: Test results Soil sample site for experiment implementation.

Chemical Operational Description for Managing Weeds

For chemical control in chickpea, thin leaf weeds were used from Gallant Super (Haloxy fop – R methyl)herbicides to a ratio of 1 liter per hectare in the time of 2-4 thin leaves of weeds for the main two methods of tillage, In order to control broad-leaved weeds, both main tillage methods were not used because of economical for chemical struggle with broad-leaved weeds and thin leaves of wheat, respectively, the topic (Clodinafop-propargyl) 1 liter per hectare and grandmaster (Tribenuron Methyl) 15 grams per hectare at during wheat tillering in early spring, wheat was used in both of the main tillage.

Main tillage treatments:

T1: Deep inversion tillage method Moldboard + two secondary tillage with a disk

Non-inversion tillage methods With

T2: tillage with Chisel plow alone

T3: Chisel plow with Single Basket Roller

T4: Chisel plow with double finger roller.

Specifications of used operating machines

Moldboard plow (speed approximately 4.7 km/h), no of bottoms 3, effective width of work 0.9 m, weight about 350 kg, working depth 30 (cm)

In all the cases, a tractor (ITM 399.4WD, Iran), having an engine power of 110 HP was used as the power source.

No of tins	5
Working width $_{cm}$	220
Working depth $_{cm}$	15
The Power required $_{hp}$	100
No. of leveler	4
Total weight $_{kg}$	740
Forward speed	10 $_{km/HR}$
Blade width cm	40 $_{mm}$
Angle of attack	45degrees

Table 2: Technical data of the chisel used in the operation tillage.

Weeds prevailing in the study area

In each treatment, a random sampling of three points was performed and all weeds in those areas were harvested from the soil surface, the species, number, fresh weight, and weeds were determined and recorded.

In wheat

Broadleaf: *Convolvulus arvensis, Galium* spp, *Anthemis* spp, *Vicia* spp, *fumaria vaillantii,* Glycyrrhiza as, Turgenia latifolia, cephallaria syriaca

Thin leaf: *Hordeum* spp, *Avena fatua* L, *Secale cereale* L, *phalaris minor*

In chickpea

Broadleaf: *Cichorium intybus* L

Thin leaf: *spontaneum Hordeum, Hordeum murinum, Hordeum spontaneum*

Design and Analyzing data

The experiment was a split plot in a randomized complete block design with four replications in rotation with wheat and chickpea was used for this field, experiment with plot size 6m × 8m with wheat and chickpea during both the years. Analyzing data, including analysis of variance, Comparison of means by means of the least significant difference, insignificant traits in the analysis of variance tabled The Duncan multi-scope method was used for non-significant traits in the analysis of variance table using SAS software.

Implementation

In reduce tillage plots, a non-inversion tillage step was performed by three tillers and then planting the wheat using the drill planter. In deep inversion tillage plots, a plowing step with a moldboard plow and a disc step. In reduced tillage plots, a protective tillage step was carried out using three soil tillage methods performed one-time protective preceding by three tillers and then planting was done using drill planters. It was considered that the spacing of the rows of 17 cm and the consumption of seeds of 180 kg per hectare for wheat and 80 kg per hectare chickpea, the plant density in this study was wheat 200-250 and chickpea 30-35 plants per square meter, the use of chemical fertilizer was determined according to the results of the soil test and based on the amount of consumption of 100 kg of triple superphosphate with 50 kg of urea (carbamide) per hectare and was used at planting time. On average, 50 kg of urea fertilizer was used in the spring because of the appropriate time.

Field measurements

Standard operating procedure residues content determination

The tillage operations were performed with 30% of the wheat residues and with 10% of the residues of the chickpea for protective tillage. The residues of till land for the four tillage methods, samples were taken randomly. A quadrat, a meter square of wood shown in figure 1, was used for this purpose.

Figure 1: A quadrat, a meter square of wood, is being thrown randomly to take samples of the residues for each tillage method.

Standard operating procedure dry weight of weed content determination (gr/m^2)

Experiments on determining the dry weight of weeds using launchers (dimensions 0.5-0.5 m) during the plots were performed as a random and zigzag plot of 4 dots. The Primary tillage plots were planted in autumn and according to weather conditions late March to mid-April in wheat and in the dry land 8 weeks after planting, weeds were recorded and identified for weed species. Then weeds were transferred to the oven at 72°C and their dry weight was determined after 48 hours with a precision digital scale of 0.01 g. after the harvesting operation in September of the following year, the experiments were carried out for the second time again.

Sources of change	Degrees of Freedom	Means of square (MS)		
		0 - 10 cm	10 - 20 cm	20-30 cm
Tillage (T)	3	14.48**	7.90**	5.48**
The main error	43	4.4815	2.72092	3/833
Crop B	1	4.27**	6.14**	2.68$^{(n.s)}$
A×T	3	0.07 $^{(n.s)}$	0.88$^{(n.s)}$	0.43$^{(n.s)}$
Sub error	3	20.06612	16.46178	23.92024

Table 3: Analysis of variance (mean square) dry weight of weed in different types of soil tillage.

*. **: Statistically significant at P = 0.05 and P = 0.01 significance level, respectively. ns: not significant.

Figure 2: A randomized method for measurement weed dry weight.

Chart 1: Mean changes in dry weight of thin leaf weeds of chickpea affected by tillage treatments (gr/m$_2$).

Chart 2: Mean changes in dry weights of broadleaf weeds of chickpea affected by tillage treatments (gr/m$_2$).

Chart 3: Mean changes in dry weight of thin leaf weeds of wheat affected by tillage treatments (gr/m$_2$).

Results and discussion

The results of the experiment showed that the mechanical operations of soil tillage (wheat + chickpea) in rainfed areas were one of the problems of weed management and increased weed dry weight. So, using suitable tillage method, we can maintain soil moisture storage with weed control.

The weed species that were plotted from the field surface were Described as follows

In wheat after chickpea

For the chemical and mechanical struggle with thin leaves in the previous culture (chickpea), an average of 77% of the broadleaf weed species was observed in the following species *Convolvulus arvensis*, *Galium* spp, *Anthemis* spp, *Vicia* spp, Turgenia latifolia and 23% thin leaves, *Galium* spp, *Anthemis* spp, *Vicia* spp, *fumaria*

Chart 4: Mean changes in dry weights of broadleaf weed of wheat affected by tillage treatments (gr/m_2).

vaillantii, Glycyrrhiza as, *Turgenia latifolia,cephallaria syriaca* and 23% thin leaves, *Hordeum* spp, *Avena fatua* L, *Secale cereale* L, *phalaris* minor. In the sampling of surface tillage, it is observed more than the deep tillage *Hordeum* spp, *Avena fatua* L.

In chickpea after wheat

For the chemical and mechanical struggle with thin leaves in the previous culture (wheat), an average of 84% of the broadleaf weed species was observed in the following species: *Cichorium intybus* L. Convolvulus arvensis. In the sampling of surface tillage, it is observed more than the deep tillage 12% *Convolvulus arvensis* and 4% other broadleaf weeds.

As shown in the diagrams

- **Chart 1:** It was observed in chickpea grown after wheat lowest amount of thin leaf weed dry weight in moldboard and the highest amount was increased by 7-8% in chisel+ single basket roller in this method of tillage,the lateral motion of the soil compared to the moldboard tillage, which is more deep soil movement, reduces the transfer of the seeds of seed weeds to the surface, therefore, the seeds of thin leaf weeds in chisel+ basket roller were more than other tillage methods.

- **Chart 2:** It was observed in chickpea grown after wheat lowest amount of thin leaf weed dry weight in chisel without roller and the highest amount was increased by 7-8% in chisel+ single basket roller in the tillage method with a moldboard, the deep soil transfer to the surface was high It has increased the displacement of broad-leaved weed seeds to the surface. This results in a significant increase in the displacement of broadleaf weed seeds to the surface.

- **Chart 3:** It was observed in wheat grown after chickpea lowest amount of thin leaf weed dry weight in moldboard and the highest amount was increased by 8% in chisel+ basket Roller in thin leaf crops of the annual plant that are grown after broadleaf row plants due to control weeds in the crop of weed density reduction can be observed.

- **Chart 4:** It was observed in wheat grown after chickpea lowest amount of broadleaf weed dry weight in chisel without roller and the highest amount was increased by 7 - 8% in moldboard + two secondary tillage with a disk.

Conclusion

Results of the experiment of surface non-inversion tillage compared to deep inversion tillage on weed dry of wheat and chickpea, the results of this study showed the geometric shape of the roller, as well as the geometric shape of the chisel blade, have a great influence on the lateral and vertical displacement of the soil. In surface plowing, the result was an increase in weed seeds at the surface. By examining the density of species in this method, after a few years, the density of leaf weeds increased. But in deep plowing, due to increased depth displacement relative to the soil surface seed and weeds of broadleaf and perennial weeds increase, therefore, by implementing surface tillage accompanied by chemical and mechanical methods of weeding, we reduce the dry weeds in the long run.

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