

Effect of fertilizer and cover crop on yield and yield components of soybean

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ABSTRACT: In order to study the effect of fertilizers and cover crop on yield and yield components of soybean, an experiment was conducted in Research field of Islamic Azad University of Shirvan in 2014 growing season. Treatments included fertilizers and weeding. The experiment conducted as factorial based on randomized complete block design with 3 replications. The results showed that the most seed yield belonged to the treatment of chemical fertilizer + weeding with 770 kg/h and to the vermicompost+ weeding with 748 kg/h. The most biological yield with 2787 kg/h observed in the treatment of chemical fertilizer + cover crop. After this treatment chemical fertilizer + weeding and vermicompost + weeding, produced more biological yield of 2648 and 2164 kg/h respectively than other treatments.

Keywords: vermicompost, cover crop, seed yield, soybean

INTRODUCTION

Soybean is one of the most important oil seed crop from Fabaceae family and is considered as a high potential plant in providing of human, livestock and industry necessities (Egbe, 2010). In aspect of oil production in world soybean is in first place among oil seed crop and is considered as an important source of oil and plant protein production. Some properties like nitrogen fixation and little demand for phosphorus caused more attention of farmers to this plant (Khakzad et al., 2012). Weed competition is one of the most important barriers of crop production. Cover crop is one of the effective methods of weed control. In addition of land cover and weed control by cover crop, they also increase sustainability and biodiversity. In an experiment, effect of cover crop of rye, rapeseed, triticale and barley on weed control of potato was studied and reported that these plants decreased the weed population compared with control treatment (Ghaffari et al., 2012). It was declared that cover crop residues decreased weed population in soybean and potato (Ateh and Doll.,1996; Boydston and Hang.,1995). Mouedi Shahraki et al (2011) reported that the most head number per plant in safflower belonged to the treatment of combination of triticale and vetch cover crop accompanied with surface mulch. In another experiment cowpea was used as a cover crop in sorghum farm which was turned to soil at the stage of 10 leaves of sorghum, controlled weed plants of sorghum, successfully(Aghayari et al.,2012).

Soil organic matters impose direct and indirect effect on crop production through providing of nutrients and also improvement of soil physical condition and stimulation of plant growth. It also seems that plant production based on application of organic fertilizers is more stable than application of chemical fertilizers. So, there has been lots of attention from agronomists, ecologists and consumers toward organic fertilizers.

Karimi et al (2011) reported that application of vermicompost significantly increased corn yield compared with control treatment. Mottaghian et al (2009) evaluated yield components of soybean in response to different fertilizers and reported that the most pod number per plant observed in vermicompost treatment. In an evaluation about organic matters effect on dry matter of tomato reported that the most dry matter observed in the treatments of chemical fertilizer and vermicompost (Mirzayi Talar Poshti et al., 2009). Jat and ahlawat (2006) reported that vermicompost

increased significantly pod number per pea plant. They believed in better providing of nutrient for plant with application of vermicompost. Saleh abadi et al (2014) reported that consumption of 14 t/h vermicompost and 50 t/h of cow manure produced more yield in Cucumber in comparison with chemical fertilizer. In other experiment, effect of organic fertilizer on Rapeseed yield was studied and reported that treatment of 50 t/h cow manures produced the most seed yield (875 kg/h) in deficit irrigation condition (Azimzadeh et al., 2013).

In another experiment, the most node number, pod number per plant and seed number per pod in soybean observed in the treatment of chemical fertilizer compared with cow manure (Myint et al., 2009) but Molafylaby et al (2012) reported that application of 40 t/h cow manure caused the most economic yield of garlic.

This experiment was conducted to determine the effect of organic fertilizers and sesame cover crop on yield and yield components and soybean.

MATERIALS AND METHODS

In order to evaluate the effect of fertilizer and sesame (*Sesamum indicum*) cover crop on weed biomass, yield and yield components of soybean an experiment was conducted as factorial based on randomized complete block design with 3 replications. This experiment was conducted in research farm of Islamic Azad University of shirvan with latitude of 37:21 and longitude of 58:04 and the height of 1114 meters above sea level. Treatments included, fertilizer and weeding. Fertilizer treatments included, chemical fertilizer (100 kg/h phosphate and 200 kg/h urea), vermicompost (10 t/h), cow manure(50 t/h) and control (lack of fertilizer). Weeding included ,hand weeding, lack of weeding and cover crop. After moldboard plow, disking and leveling of land, plots with 9 m² area and 1m distance from each other were prepared. Distance between replications was 2 meter. All of applied fertilizers in the plot mixed with soil in 20 cm depth. One-third of urea fertilizer was scattered in the plot at planting and the rest were applied as topdressing in V2 vegetative stage.

Seed of Williams variety of soybean disinfected by Benomyl fungicide and was planted on rows with distance of 75cm. the seed distance on row was 5cm. The seed, density was 300 seeds/m². sesame was planted with soybean between it's rows simultaneously in cover crop treatment. Drip irrigation was done after planting immediately. Other irrigation was done with 7 days interval. weeding by hand was done in two stages of V3 (25 days after planting) and R₁ (52 days after planting).

In order to determine yield components, 5 plants from each plot were select randomly and traits of the first pod height from soil surface, node number per plant, pod number per plant, seed number per pod and hundred kernel weights were measured. in order to obtain weeds dry weight, all of the weeds of each plot gathered and dried in oven in 70 °c for 48 hours. Analysis of variance was done by MSTATC software and mean comparison was don by Duncan's multiple test range.

RESULTS AND DISCUSSION

Effect of fertilizers, weeding treatment and their interaction effect on recorded traits was significant on 1% level of probability(Table 1).

Table 1. Analysis of variance of soybean yield and yield components under the effect of fertilizer and weeding

Sources of variation	Degree of freedom	First pod height	Node number per plant	Pod number per plant	Seed number per plant	Hundred kernel weight (g)	Biological yield	Seed yield
Replication	2	5/2581778	0/0543861	30/987303	52/54778	1/4847583	11692.7	8.6
Fertilizer (A)	3	9/7614222**	25/4817287**	1444/048544**	7642/78333**	36/9441926**	1158513.5**	102666.4**
Weeding (B)	2	56/5388444**	55/1351361**	2887/265469**	16484/75444**	11/9676000**	2130173.0**	121911.6**
Interaction Effect A*B	6	9/7536000**	3/7821731**	577/216210**	3326/33222**	3/9620593**	241656.1**	15692/8**
error	22	1/4363111	1/0336891	16/82827	51/26293	1/1032886	4186.4	907/1
Coefficient of Variation		9/8	7/2	11/7	9/2	13/2	7.2	15.7

** , Significant at 1% levels of probability

As shown in table 2, in all fertilizer treatments the first pod height from soil surface in weeding treatment was lower than other weed treatments. The first pod height from soil surface in chemical fertilizer and weeding was 9 cm,

in vermicompost and weeding was 8 cm, in cow manure and weeding was 11.6 cm and in lack of fertilizer and weeding was 11.6. First pod height from soil surface in different fertilizer treatments and lack of weeding was quiet reverse. Exception of cow manure and lack of weeding in other fertilizer treatments with lack of weeding first pod height from soil surface was more than other treatments. It is likely due to this fact that in unwedded treatment soybean showed more competition with weed plant and so has reached to higher height of first pod.

Table 2. Soybean yield and yield components under the effects of Fertilizer and weeding.

Fertilizers treatments	Weed treatments	First pod Height(cm)	Node number per plant	Pod number Per plant	Seed number per plant	Hundred kernel weight (gr)	Biological yield(kg/h)	Seed yield(kg/h)
Chemical Fertilizer	Weeding	9/0 ^g	16/0 ^c	55/4 ^c	124.8c	9.7b	2648 ^b	770/8 ^a
	Lack of weeding	15/6 ^b	13/8 ^e	22/9 ^g	47.8g	8.8c	1780/6 ^f	430/0 ^f
	Cover crop	12/8 ^d	16/8 ^b	67/4 ^b	148/5b	13.8a	2787 ^a	713/9 ^b
Vermicompost (10 t/h)	Weeding	8/0 ^h	17/7 ^a	74/5 ^a	176.5a	8.2d	2583 ^c	748/7 ^c
	Lack of weeding	13/9 ^c	12/9 ^g	21/8 ^g	46/6g	7.2e	1463/4 ⁱ	399/4 ^g
	Cover crop	10/4 ^f	14/3 ^d	30/1 ^e	67.8e	8.3d	1551/6 ^h	460 ^{de}
Cow manure (50 t/h)	Weeding	11/6 ^e	15/9 ^c	38/3 ^d	87.6d	6.4g	2164 ^d	474/6 ^d
	Lack of weeding	11/4 ^e	11/2 ^h	13/2 ^h	24.4i	5.8h	1252/2 ^k	340 ⁱ
	Cover crop	13/0 ^d	13/4 ^{efg}	31/4 ^e	66.6e	7.2ef	1622/8 ^g	425/7 ^f
lack of fertilizer	Weeding	11/6 ^e	13/6 ^{ef}	26/2 ^f	54.8f	6.6g	1870/1 ^e	450/2 ^e
	Lack of weeding	16/6 ^a	8/5 ⁱ	14/3 ^f	31.6h	6.2gh	1398/2 ^j	371 ^h
	Cover crop	11/7 ^e	13/3 ^{fg}	22/9 ^g	52.4f	6.7fg	1574/3 ^h	410/9 ^g

*, In each column, means with the same letters are not significant at 5% level of probability.

As in table 2, the most node number per plant was obtained in the treatment of vermicompost + weeding (17.7) and in the treatment of chemical fertilizer + cover crop (16.8) and chemical fertilizer + weeding (16). Vermicompost is a kind of bioorganic fertilizer which does not have any seed of weed plants, is lightweight, does not smell and contain microelements. Some growth regulator, macro and micro elements in vermicompost can stimulate plant growth and development. (Barcker and Bryson 2006, Atiyeh et al, 2000). Azarpour et al (2012) also Reported the same result with application of vermicompost and nitrogen biofertilizer. In another experiment, the most node number per plant was reported in vermicompost treatment (Myin et al., 2009).

In this experiment, the least node number belonged to the treatment of lack of fertilizer and lack of weeding (8.5). It is obvious that nutrient deficiency and more weed causes lower plant growth and development that led to lower node per plant. The lowest pod number per plant and seed number per plant was counted in the treatment of cow manure+ lack of weeding (13.2 and 24.4 respectively). This is because of lower node number per plant in this treatment (11.2) that causes lower branch number which resulted in lower pod number per plant and lower pod number per plant resulted in lower seed number per plant. Hundred kernel weights in this treatment were also the lowest compared with other treatments (5.8 gr). These are the reason for the lowest seed yield (340 kg/h) in treatment of cow manure+ lack of weeding. The most hundred kernel weight belonged to the treatment of chemical fertilizer + cover crop. In another experiment, it was reported that the most thousand kernel weight of soybean belonged to the treatment of chemical fertilizer and vermicompost (Mottaghian et al., 2009).

The most biological yield observed in the treatment of chemical fertilizer + cover crop with 2787 kg/h. After this treatment chemical fertilizer + weeding with 2648 kg/h and vermicompost + weeding with 2583 kg/h produced more biological yield than other treatments (Table 2).

The most seed yield belonged to the treatment of chemical fertilizer + weeding with 770.8 kg/h. vermicompost + weeding with 748.7 kg/h was in second order. In spite of significant difference of seed yield in chemical fertilizer+weeding and vermicompost +weeding this difference was 21 kg/h. Vermicompost is a kind of bioorganic fertilizer which does not have any seed of weed plants, is lightweight, does not smell and contain microelements (Barcker and Bryson 2006, Atiyeh et al, 2000). This microelement and some growth hormone of vermicompost can stimulate plant growth and development. Lack of weeds in weeding treatment and availability of chemical fertilizer provided suitable condition for plant growth and development that lead to higher seed and biological yield in chemical fertilizer+

weeding treatment. The same result reported by ShiriJanagard et al (2013). Myint et al (2009) also obtained the most seed yield in the treatment of chemical fertilizer rather than cow manure.

Generally the results of this experiment showed that the treatment of chemical fertilizer+ weeding produced the highest seed yield compared with other treatments. Biological yield of this treatment although was lower than chemical fertilizer+ cover crop but relatively was higher than other treatments. The reason for higher biological yield in chemical fertilizer+ cover crop maybe is the competition of soybean with cover crop that resulted in higher vegetative growth at the expense of seed yield. If the cover crop does not compete with crop, seed yield decrement may not happen. Seed yield of vermicompost + weeding was in second order after chemical fertilizer + weeding. Although seed yield of this treatment was lower than Chemical fertilizer + weeding but vermicompost according to environmental aspect compared with chemical fertilizer is more important.

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