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Research Article

THE EFFECT OF DIFFERENT FERTILIZATIONS AND REDROOT PIGWEED DENSITY ON YIELD AND Yield COMPONENTS OF SOYBEAN (*GLYSINE MAX*)

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ABSTRACT
To study the effects of different levels of fertilizers and redroot pigweed as an important weed competition on yield and yield components of soybean, the experiment was carried out in 2012-2013 years at Agricultural Research Station of Islamic Azad University, Sanandaj Branch in the form of splits in a randomized complete block design with three replications. The treatments were fertilizers including: manure, compost, chemical fertilizer, manure + compost, manure + compost + chemical fertilizer and control (without fertilizer) as the main plot and sub plot is density of redroot pigweed at three levels were: zero, 20 and 40 pigweeds per unit area. The results showed that the combined use of fertilizer, manure and compost and manure in terms of agronomic traits and yield of soybean was superior to other treatments. It enhanced the functionality and performance of soybean yield and weed density increased from 0 to 40 plants and caused decline in soybean performance. It suggests the role of competition between species than within species of weeds.

Keywords: *Fertilizers, Mixed Fertilizer, Weed Density, Competition and Soybean*

INTRODUCTION
Weeds are the most important factors limiting the growth of crops. Each year, 25% of production of broad-leaved weed disappears due to competition with weeds. However, the growth and damage of weeds is directly affected by farm management. The dominant weed species and weed density is effective on the amount of compensation (Rashedmohasel and Vafabakhsh, 1999).
Due to financial and environmental pressures in relation to reducing herbicide, careful management of weeds can be turned into something interesting and unique opportunity in agriculture (Johnson, 2006). One of the objectives of precision agriculture is to minimize the amount of herbicide through the use of appropriate management systems (Carlos and Hill, 1995). Competitive relationships are dominant between crop plants and weeds. In other words, there is a hierarchy for competition within agricultural systems and weed management impose unrealistic conditions in the system and between crops and weeds (Loghavi and Mackvandi, 2008). Micronutrients play an important role in the physiological processes of plants and improve crop growth and increased competitiveness in competition with weeds (Jamali and Alahyary, 2005).
Oilseeds used in human food consumption and use of press cakes for animals and their use in manufacturing industries have drawn agricultural interest. Discovery of plant protein in the products and using them instead of meat and fish protein and the introduction of oilseeds such as soybeans into global markets and the increasing demand for its products, including milk and tofu because of the gravity of this product are increasing (Naseri, 1996).
Blackshu (2005) showed that a slow release of nitrogen, compost, weeds will reduce damage of weeds. Another influence on the yield and grain quality is the availability of nutrients. The development of plant and animal resources used in renewable biological resources instead of chemical resources in crop rotation can play an important role in maintaining fertility and biological activity, soil organic matter, crop and enhancing the ecological health and quality of crops (Zaidi *et al.*, 2003). Using compost and manure increased root length, total dry matter, nitrogen uptake and yield of oilseeds (Saha *et al.*, 2008). Dawson (1965) argues that competition in condition of the joint application of two or more adjacent

plants may cause death, reduced growth, delayed puberty, reproduction and reduce the performance. Bench *et al.*, (2003) stated that the review of competition with soybean weed density increases, soybean yield reduces depending on the yield loss, weed density and seed germination. They showed that maximum soybean yield loss occurred when pigweed density of 8 plants in row meters were planted with soybeans simultaneously. Abbasian *et al.*, (2001) reported that pigweed impacts each weed plant dry weight, number of pods and soybean. However, with increasing density due to competition between weeds plant, the effect of pigweed on the mentioned traits has lowered. At low densities of weeds, adding nitrogen to the soil, can increase crop yield and minimize weed competition significantly. While in high weed densities, the addition of nitrogen leads to further growth of weeds and has little or no role in improving crop yield (Basu *et al.*, 2008). Placing a shade on soybean reduces production and thus the amount of photosynthetic proteins is reduced and the amount of light for flowering and pod development and finally declines (Hindel and Brun, 1984). Studies indicate the fact that a major limiting factor for the growth of the weed is nitrogen (Blake Shaw *et al.*, 2002).
In this research, evaluated of the effects of various fertilizers and redroot pigweed densities on soybean yield and yield components.

MATERIALS AND METHODS

The research was conducted in the 2012-2013 at the College of Agriculture and Natural Resources, Islamic Azad University, Sanandaj Branch, located at 10 kilometers from Sanandaj -Kermanshah road of Iran. The height above sea level is 1393 meters long with a width of 46° 59' eastern longitude and 35° 10' north. The mean annual temperature and precipitation in the region, according to statistics are 28.4 ° C and 471 mm. Experiment was carried out in clay loam soil with an average of pH=7.7 and EC= 55.0 $mmos.cm^{-1}$.

The experiment was a split plot in a randomized complete block design with three replications. Different fertilizers in six levels include manure (20 $t.ha^{-1}$:N_1), municipal solid waste compost (10 20 $t.ha^{-1}$:N_2), chemical fertilizers (100 $kg.ha^{-1}$ of triple superphosphate+120 $kg.ha^{-1}$ of urea and 50 $kg.ha^{-1}$ of potassium sulphate: N3), 5 $t.ha^{-1}$ of municipal solid waste compost + 10 $t.ha^{-1}$ manure (N_4), 5 $t.ha^{-1}$ of municipal solid waste compost + 10 $t.ha^{-1}$ manure + 50 $kg.ha^{-1}$ triple super phosphate + 60 $kg.ha^{-1}$ urea + 25 $kg.ha^{-1}$ of potassium sulphate (N_5) and control (without using fertilizers: N_6) were identified as the main plots. Three different densities of redroot pigweed include zero (D_1), 20 (D_2) and 40 (D_3) plants per unit area as sub plot determined.

Redroot pigweed seeds were planted simultaneously with soybean seeds. To determine the nutrient status of the soil in the plots before planting, experiment samples were taken and soil texture was analyzed by using laboratory analyses of soil and water in Kurdistan Province by using hydrometer method, EC and pH of soil according to the method of Johnson *et al.*, (1997). Also, manure and compost were analyzed before use to determine the percentage of its elements.

The main plot size was 3 × 8 meters and three sub-plots in each main plot size and plot were classified into 3 × 2 meters. Row spacing of 50 cm and 5 cm plant spacing were considered. Planting a line between each sub-plot was applied. During the experiment all the weeds, except pigweed were manually removed. At the end of the season, soybean yield and yield components were measured.

Data were analyzed using analysis of variance procedure (ANOVA) of the SAS statistical program. The comparison of means were done using Duncan's test at the level of five percent.

RESULTS AND DISCUSSION

Fertilizers and weed density had a significant effect on yield and yield components of soybean (Table 1).

Table 1: Analysis of variance for yield and yield components of soybean under different systems of fertilizing and weed density

SOV	df	MS						
		Plant height	LAI	Chlorophyll content	Pod No	Grain in pod	100 kernel weight	Grain yield
Replication	2	100.5ns	2.6ns	114.6*	460.5ns	0.056ns	10.11**	17760.1ns
Fertilizers	5	710.4**	6.8**	7.1ns	820402.4**	0.158**	21.7**	2110402.1**
Error a	10	218.4	0.7	9.5	1708.4	0.017	1.54	3145.4
Weed density	2	25541.1**	5.66*	125.2*	1131041.1**	0.115**	41.18*	28131741.1**
Fertilizers× density	10	296.2ns	1.7	25.8ns	516.2ns	0.007	11.38ns	2316.2ns
Error	24	2040.1	1.01	8.2	3250.1	0.001	6.62	3750.3

*ns, * and **: non significant, significant at 5 and 1% probability levels, respectively.*

Plant Height, Leaf Area Index and Chlorophyll Content

The results showed that fertilizer levels and weed density had significant effect on plant height and leaf area index. However, the effect of weed density on chlorophyll was not significant (Table 2).

The highest plant height was obtained chemical fertilizers application (N_3), and the combined use of chemical fertilizer, manure and compost (N_5) respectively. Increasing weed density from 0 to 20 and 40 plants per square meter increased soybean height significantly (Table 2).

Table 2: Effect of different systems of fertilizing and weed densities on soybean agronomic traits

	Plant height (cm)	Leaf Area Index	Chlorophyll content (CCI)
Fertilizers			
Manure	73.7 b	4.6 b	32.2 e
Compost	73.9 b	4.6 b	32.8 d
Chemical fertilizer	93.2 a	5.5 a	36.3 b
Compost+Manure	75.6 b	5.5 a	32.9 c
Chemical+Manure+Compust	85.5 ab	5.6 a	39.9 a
Control	53.6 c	3.9 c	27.3 f
Density of pigweed			
0	45.9 c	5.6 a	33.7 a
20	77.2 b	4.9 b	33.6 a
40	105.1 a	4.2 c	33.6 a

Different letters in each column indicate significant differences using Duncans test at the 5% probability level.

The comparison between the different levels of fertilizers showed that the highest concentration of chlorophyll was obtained in the combined of organic and chemical fertilizers (N_5) application. Increasing weed density had not significant effect on chlorophyll content (Table 2). Availability of minerals such as iron, magnesium and manganese combined with the use of compost and manure and fertilizers can be one of the reasons of increasing chlorophyll is this treatment.

The results showed that different fertilizers such as combined of organic and chemical fertilizers (N_5), Compost+Manure (N_4) and Compost (N_3) had the highest leaf area index and control (N_6) had the lowest of this trait. Increasing redroot pigweed density from 0 to 20 and 40 decreased soybean leaf area index significantly (Table 2).

Leaf area index, leaf expansion rate and leaf area distribution in the canopy are among the main optical characteristics affecting the competitiveness of the crops and grass weeds. It seems that with the increase of pigweed, canopy space occupied by weeds decreases and soybean leaves for development will be reduced. Another reason for the decline of soybean leaf area is accelerated aging and leaf abscission under competitive conditions. Tollenaar *et al.*, (1997) showed that leaf water potential, stomata conductance, chlorophyll content, and photosynthesis reduced in corn affected by weeds, also.

Pods No. per Plant, Grain in pod, 100 Kernel Weight

Increasing pigweed density from 0 to 20 and 40 plants per square meter fertile soybean pods decrease 13.3 and 38.6% respectively (Figure 1). Increase of pigweed density reduces available resources such as light, water and nutrients, and lack of resources, decreased synthesis and produced assimilate (Holt, 1995).

The highest pods per plant was obtained in the combined of organic and chemical fertilizers (N_5) application as 27.1 and the lowest (8.9) was obtained in control (Figure 2). Supply of nutrients has an important role in increasing the number of grains per pod (Rudrash *et al.*, 2005).

The highest grains per pod (2.8) was obtained in the combined of organic and chemical fertilizers (N_5) application and the lowest (1.7) was obtained in control (Figure 3). Increasing pigweed density from 0 to 20 and 40 plants per square meter decreased grain no. in soybean pods 22.2 and 29.6% respectively (Figure 4).

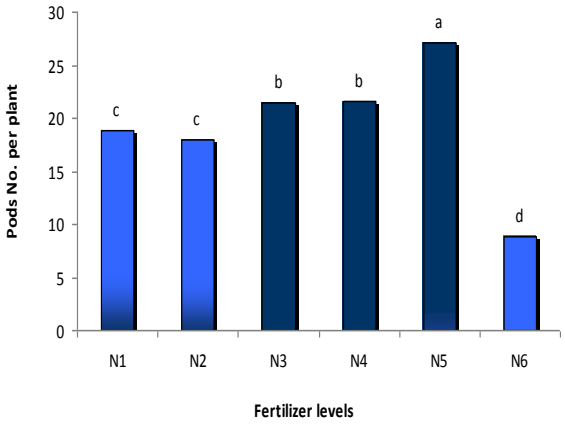

Figure 1: Effect of fertilizer levels on soybean pods no.per plant

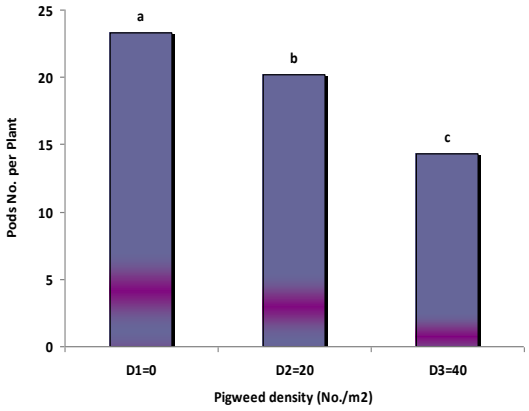

Figure 2: The effect of pigweed density on pods no. per plant

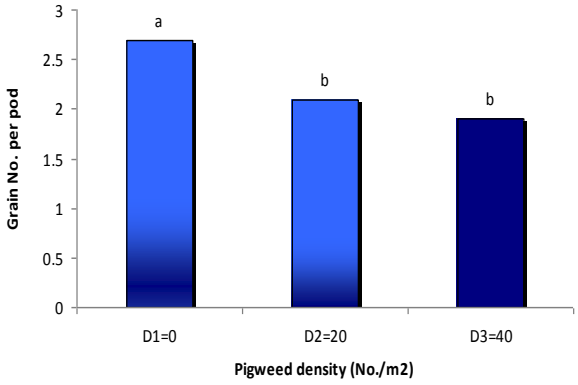

Figure 3: The effect of pigweed density on grain no. per pod

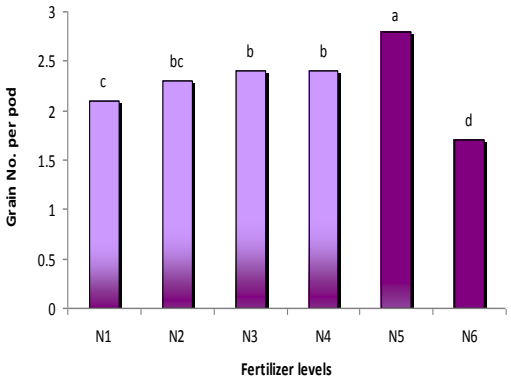

Figure 4: Effect of fertilizer levels on grain no. per pod

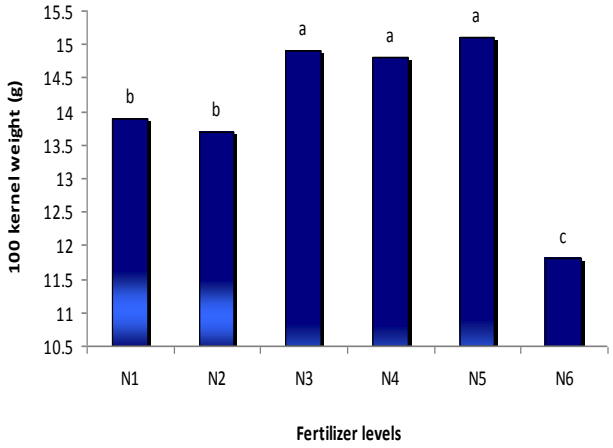

Figure 5: The effect of pigweed density on soybean 100 kernel weight

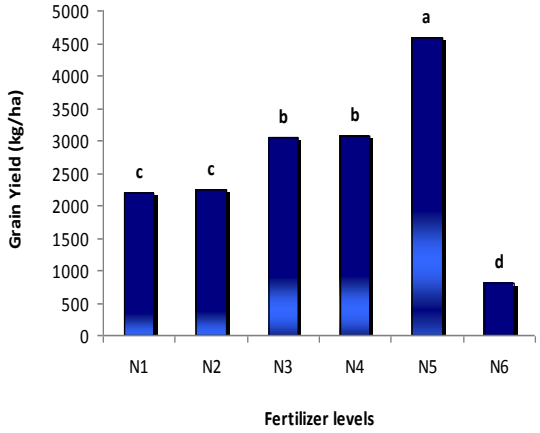

Figure 6: Effect of fertilization on grain yield of soybeans

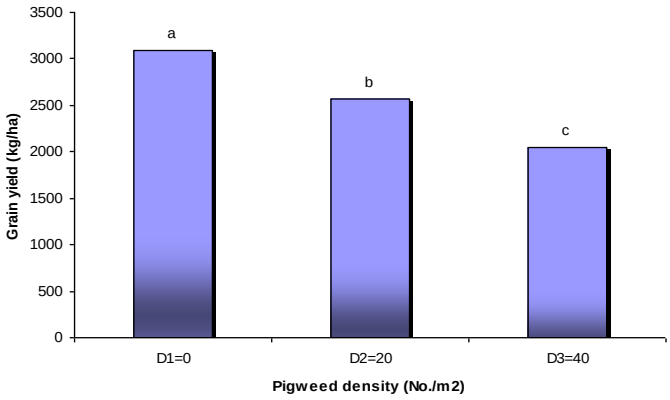

Figure 7: Effect of weed pigweed on grain yield of soybeans

Different letters in each column indicate significant differences using Duncan's test at the 5% probability level.

According to the observations and the effect of fertilization on soybean 100 kernel weight, all treatments were observed to be significantly different with respect to control. The highest weight of 100 kernels was obtained in the chemical fertilizer (N_3), combined of compost and manure (N_4) and combined of compost + manure + fertilizer (N5) and the lowest was determined in control treatment (N6). Use of combined manure and compost as compared to taking them alone due to greater availability of minerals such as phosphorus, nitrogen and other nutrients can cause 100 kernel weight to increase.

Redroot pigweed density increases from 20 to 40 plants per square meter leads to decreased levels of soybean grain yield significantly. The highest grain yield determined of control condition as 3086 kg/ha, increasing weed density from 0 to 20 and 40 leads yield to 2564 and 2044 kg/ha that is 16.9 and 33.7% reductions (Figure 6).

Increase in redroot pigweed density reduces available resources such as light, water and nutrients, and lack of resources reduced photosynthesis and produced assimilates and reduced soybean yield. Adding manure and compost provide micronutrients, which increases the competitiveness of soybean in competition with weeds compared to the control which showed significant difference. The comparison of fertilizers showed that the combined use of organic and chemical fertilizers (N_5) had the highest grain yield of soybean. Application of manure, compost, chemical fertilizers, combine of

compost and manure and compost +manure + fertilizer increased grain yield as 1380, 1430, 2240, 2245 and 3760 kg/ha compare with control condition (Figure 7).
Jayabal and Koppvswamy (2001) demonstrated that the application of composted manure compared with 10 percent more nitrogen absorbed by rice caused grain yield to have increased significantly.
Manure (N_1), Compost (N_2), Chemical fertilizer (N_3), Compost+Manure (N_4), Compost+Manure+Fertilizer (N_5),control (N_6)
Redroot pigweed density: zero (D_1), 20 (D_2) and 40 (D_3) per square meters.

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