THE DETERMINATION OF SOYBEAN (*Glycine max* L. Merr.) GENOTYPES ON KONYA ECOLOGICAL CONDITIONS FOR YIELD AND QUALITY

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ABSRACT

Soybean is one of the most important crops for animal consumption and Turkey imports almost 95% of soybean used. For this purpose, this study conducted to determine the soybean varieties for Konya region. It was carried out in 2008 and 2009the production year at the Selcuk University Sarayönü Vocational School experiment field. Six varieties (Defiance, Nova, NE 3399, Arısoy, and Atakişi A 3935) were used in the trials with three replications under irrigated conditions. The varieties are evaluated plant height, number of branches per plant, number of pods per plant, first pod height, number of grains per pod, pod length, height of the first branch, thousand grain weight, yield with protein, ash and fat ratios in terms of quality characters. The varieties were significantly different ($p < 0.01$) from each other in terms of plant height, number of branches per plant, number of pods per plant and grain yield. Arısoy was most high yielding variety with 3.625 kg ha^{-1} whereas Defiance was the lowest yielding varieties with 2.416 kg ha^{-1}. Varieties Arısoy, NE 3399, Atakişi and Nova were in the first groups in terms of yield. The highest protein content (40.2 %) and the highest oil content (18,4 %) were obtained from Defiance and NE3399 with Atakişi varieties, respectively. According to results Arısoy for grain yield and NE3399 with Atakişi for yield and protein can be recommended to Konya region.

Keywords: soybean, cultivar, yield, quality

INTRODUCTION

Soybean is accepted as "gold plant" of the present century [1] due to it's usage area in the production of more than 400 industrial products, 18-24% oil content, 36-40% protein, 5% mineral elements (phosphorus, potassium, calcium, sulfur, magnesium etc.) and many of the vitamins- mainly vitamin A and B [2], rich and valuable amino acids in the seeds.

A ratio of 1/3 edible oil and 2/3 of protein source is provided by soybean over the world [3]. Soybean and its oil is important in human nutrition in terms oil heart diseases, cholesterol balance in blood, osteoclasis treatment with regards of the omega-3 fatty acid (Linolenic acid) which is 10-20 times more than corn, olive and sunflower. Because of the mentioned components in soybean seeds, it is also called as "food pill". Additionally, the ratio of P/S (unsaturated fatty acids/saturated fatty acids) has a higher value (around 5.7) which is more than the other plants [4-5]. Oil cake of the soybean is also valuable in animal feeding with a higher protein ratio (50%).

Soybean - a legume crop is in the capable of nitrogen fixation by symbiotic living with *Rhizobium (Bradyrhizobium) japonicum* bacteria in the roots. The plant is able to nitrogen fixation approximately 10-20 kg da^{-1} per year [6] and this value might reach to 30 kg da^{-1} per year [7].

Origin of the soybean is accepted as East Asia- probably China is one of the oldest cultivated plants. In the world, soybean is cultivated in 106.000.000 ha and has 253.000.000

tons of production quantity [8]. Main soybean growers of the world are USA, Brazil, Argentina, China and India respectively [8].

Table 1. Main soybean producers of the world (2012)

Country	**Area Harvested (000 ha)**	**Production (000 ton)**	**Yield (kg ha^{-1})**
USA	30.798.	82.054	2.664
Brazil	24.937	65.700	2.634
Argentina	19.350	51.500	2.661
China	6.750	12.800	1.896
India	10.800	11.500	1.064
Turkey	31	115	3.639
World	106.625	253.137	2.374

Source: [8] (FAO Statistical DataBase- www.fao.org)

Soybean which is an important plant for both nutrition and industry has not took its rightful place in Turkey and, the oil cake and oil of soybean is being imported Turkey. In fact, Turkey has a suitable ecology to growing of soybean. Soybean could be grown as a second crop in the Aegean, Mediterranean and Southeast Anatolian regions. In Turkey, the first soybean was grown in Black sea Region during 1940s. Production area and quantity of soybean increased in Çukurova region of Turkey during 1980s by the second crop Project of Ministry of Agricultural and Rural Affairs, but, soybean production decreased in the following years because of the some economic and agricultural factors [1]. In 1987, 250.000 tons of soybean production was made in 112.000 ha of harvesting area, this values was changed to 115.000 tons of production in 31.559 ha of harvesting area (Table 1).

Soybean has a big importance to be a rotation crop in agricultural production systems by acting on preserving of soil yield and its sustainability with regards of being a legume crop. Besides that, the rotation systems which is included the soybean and increasing in production is needed due to annual oil requirement and high cost of imports in Turkey.

MATERIAL AND METHOD

In the present research, a total of six soybean (Glycine max L. Merr. ; Defiance, Arısoy, Atakişi, A3935, NE3399 and Nova) varieties were used as material. Field trials were made in the trial farms of Selcuk University, Sarayonu Vocational School in Sarayonu Town/Konya for two years. The soil characteristic were clay-loamy, slightly alkali, slightly salty, a normal level of organic matter and has much of lime (Table 2).

Table 2. Soil characteristics of the experimental fields

Texture	pH	E.C. (mS/cm)	Lime (%)	Organic matter (%)	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
Clay loam	7,75	4,34	18,91	2,35	0,63	20,16

The experiment field has an altitude of 1055m and, climatic data is shown in Table 3.

Table 3. Climatic data of the experiment field

Climatic parameters	*Years*	*Months*											
		1	2	3	4	5	6	7	8	9	10	11	12
Average maximum temperature (°C)	2008	10,3	7,5	26,6	31	30,5	34,3	36,8	36,1	32,4	24	19	16,6
	2009	13,1	14,7	19,5	21,2	29,6	33,3	34,6	34,4	31,2	27,6	19,8	16,4
	Long years	4.7	6.8	12.0	17.4	22.2	26.8	30.2	30.0	26.1	20.0	13.0	6.7
Average temperature (°C)	2008	-3,8	3,2	9	12,9	14,5	20,9	23,2	24,4	18,6	11,4	7,3	0,5
	2009	1,7	3,3	4,2	9,4	21,4	20,3	31	24,9	12,3	15	6,2	4,9
	Long years	-0.2	1.2	5.7	11.0	15.7	20.2	23.6	23.0	18.6	12.5	6.1	1.8
Average minimum temperature (°C)	2008	14	16	-5,2	-0,4	-0,9	7,1	11	12,4	4,3	0,2	-4,8	-18,6
	2009	-19	-8,4	-6,7	-4	3,6	7,3	11,2	6,8	2	0,7	5,7	-4,7
	Long years	-4.1	-3.3	0.0	4.5	8.6	12.9	16.2	15.7	11.2	6.1	0.8	-2.2
Rainfall (mm)	2008	5,8	20,6	11,4	11,1	5,9	13,5	6	0	48,2	30,4	36	54
	2009	41,4	23,9	22	32,7	48,5	6	20,7	0	8,5	27,1	24,8	18
	Long years	35.3	28.2	27.1	34.0	43.6	23.2	6.9	5.6	11.2	31.3	33.1	44.8

Source: TİGEM (Konuklar Agricultural Instution) meteorology station- data of DMGM

Field experiment was made according to "Randomized Blocks Design" with three replications. The plots were consisted from 5 rows with 5m of length, sowing was made by hand as 40x50cm of spaces [9]. Fertilization was made by Di ammonium phosphate (18-46%) with a dose of 200 kg ha^{-1} during the sowing time [10] and the top fertilization was not made. The seeds were inoculated by bacteria and sowing was made on 16th of May 2008 and 18th of May 2009 and harvest was made on 27th of October 2008 and 3th of November 2009 respectively. Drip irrigation was made for five hours by six times. Weed control was made mechanically. For the measurements and observations in the plots, the first and last of the rows were ignored as side effect.

Field experiments was made by following the method of INTSOY (International Soybean Program) for determination of the yield (kg ha^{-1}), plant height (cm), first pod height (cm) and number of pod per plant [10].

Statistical analysis were made by using MSTAT-C computerize based program.

RESULTS AND DISCUSSION

A research was made for two years in the Sarayonu Town/Konya ecological conditions to determination of performance on 6 soybean varieties. Results of the variance analysis are shown in Table 4.

Seed yield was 3.337 kg ha^{-1} in 2008 while this value was 2.890 kg ha^{-1} in 2009. Statistical analysis for the investigated characteristics showed importance seed the yield of the varieties. The Arısoy variety had the highest seed yield (3.625 kg ha^{-1}) and was in the first group while it was followed by the varieties of NE3399, Atakişi and Nova which were also in the same group. The variety of Defiance showed the lowest seed yield (2.416 kg ha^{-1}).

Table 4. Investigated characteristics of the varieties

Varieties	Seed yield (kg ha^{-1})	Plant height (cm)	First pod height (cm)	Protein (%)	Ash (%)	Oil (%)
DEFİANCE	2.416 c	48,9 b	12,6	40,2	4,4	17,2
NOVA	3.088 ab	61,2 a	13,9	36,9	6,6	16,5
NE 3399	3.390 ab	60,0 ab	12,2	34,5	6,7	18,4
ARISOY	3.625 a	67,7 a	15,6	36,7	4,9	17,1
A 3935	2.953 bc	59,7 ab	14,0	36,6	5,3	17,1
ATAKİŞİ	3.208 ab	62,9 a	12,3	38,9	5,9	18,4
$LSD_{(0,05)}$	626.6	11.9				
CV(%)	16.5	11.8				

Mean of the plant height was also found as statistically important. The variety of Arısoy had the highest plant height with a value of 67.7 cm and it was followed by the variety of Atakişi with a value of 62.9 cm for plant height. The second group of plant height was consisted from NE3399 and A3935 varieties by the plant height values of 60.0 cm and 59.7 cm respectively. The lowest plant hieght (48.9 cm) was measured on the variety of Defiance and it was in the last group.

Height of first pod in soybean is quite important criteria for machine harvest. In the present research, this characteristic was found as non-important in the mean of statistics. The highest value – 15.6 cm for first pod height was found on the variety of Arısoy and it was followed by the varieties of A3935 (14,0 cm), Nova (13,9 cm), Defiance (12,6 cm), Atakişi (12,3 cm)and NE3399 (12,2 cm)

Protein ratio which is a quality component was highest in the variety of Defiance with a value of 40.2% and it was followed by the variety of Atakişi (38.9%). The lowest protein ratio value was 34.5% in the variety of NE3399.

Mean of the crude ash was ranged from 4,4% (Defiance) to 6,7% (NE3399).

One of the other quality parameter - mean of crude oil rate showed the highest value in the variety of NE33399 (18.4%) and Atakişi (18.4%). These genotypes were followed by the varieties of Defiance (17,2%), Arısoy (17.1%), A3935 (17,1%) and Nova (16,5%) respectively.

CONCLUSION

According to the results of the present study, the variety of Arısoy could be advised to the region in terms of seed yield. The variety of Arısoy is also the promising genotype in terms of plant height and height of first pod that are important criteria for machine harvest.

In the view of quality parameters, the variety of Defiance is advisable due to protein and ash ratio, the variety of Atakişi and NE3399 are advisable due to oil content. Consequently, the present research showed that soybean is able to be grown in the irrigable areas of the Central Anatolian Region as an alternative plant.

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