

## Research Article

# Investigation of Second Crop No-Tilled Soybean Crop Performance in Kızıltepe Conditions of Turkey

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### Abstract

Southeastern Anatolia is a region where agricultural production is widespread under the second crop conditions. This region is one of Turkey's most important potential areas for increasing the very low soybean production amount. In this region, no-till soybean cultivation will provide a longer vegetation time by early sowing which will increase the yield of this species to high levels to compete with maize. This study was carried out to investigate the performance of no-tilled, second crop soybean performance under Kızıltepe conditions which is an important agricultural production zone of South East Anatolia.

In this experiment; Atakisi, Cinsoy, Umut-2002, Yemsoy, Arisoy, May-5312, SA-88, Blaze and Nova (*Glycine max* L.) varieties; ETA1, ETA4, ETA5, ETA6 and ETA7 lines were used as research materials. The experiments were conducted the field of a farmer in Kızıltepe subprovince (South East Anatolia of Turkey) with randomized complete block design with three replicate in 2014 year. Variety of Cinsoy produced highest yield of 3091 kg/ha. followed by varieties Atakisi and Arisoy with 2810 kg/ha. Oil content ranged between 18.5% to 23.3% and protein content was between 36.4% to 38.8%. Plant height ranged between 72.3 cm to 138.0 cm; branch number per plant ranged between 3.1 to 4.7; pods number per plant were between 43.1 to 55.3; grain number per pod were between 2.7 to 3.1 and thousand seed weight ranged between 119.5 to 153.5 g.

**Key words:** Soybean, second crop, no-till, drip irrigation, yield

## **Toprak İşlemesiz, İkinci Ürün Soyanın Türkiye'de Kızıltepe Koşullarındaki Performansının Araştırılması**

### **Özet**

Güneydoğu Anadolu Bölgesi, ikinci ürün koşullarında tarımsal üretimin yaygın olduğu bir bölgedir. Bu bölge, Türkiye'nin çok düşük olan soya üretimini artırması için en önemli potansiyel alanlardan biridir. Bu bölgede toprak işlemesiz koşullarda yapılacak soya tarımı daha erken ekim sağlayarak bu türün verimini yaygın ekilen mısırla rekabet edebilecek kadar yüksek seviyelere çıkarabilecek daha uzun bir vejetasyon süresi sağlayabilecektir.

Bu çalışma, Güneydoğu Anadolu bölgesinde önemli bir tarımsal havza olan Kızıltepe koşullarında, toprak işlemesiz, ikinci ürün soyanın performansını araştırmak amacıyla yürütülmüştür. Araştırmada materyal olarak; Atakişi, Cinsoy, Umut-2002, Yemsoy, Arısoy, May-5312, SA-88, Blaze ve Nova çeşitleri; ETA1, ETA4, ETA5, ETA6 ve ETA7 hatları kullanılmıştır. Araştırma 2014 yılında, çiftçi tarlasında tesadüf blokları deneme desenine göre 3 tekerrürlü olarak yürütülmüştür. Cinsoy çeşidi 309.1 kg/da ile en yüksek verimi vermiştir. Bu çeşidi 281.0kg/da ile Atakişi ve Arısoy çeşitleri takip etmiştir. Yağ içeriği %18.5 ile % 23.3 arasında; protein içeriği % 36.4 ile % 38.8 arasında değişmiştir. Bitki boyu 72.3 cm ile 138.0 cm; bitki başına dal sayısı 3.1 ile 4.7 arasında; bitki başına bakla sayısı 43.1 ile 55.3 arasında; baklada dane sayısı 2.7 ile 3.1 arasında değişmiştir. Bin tane ağırlığı 119.5 ile 153.5 g arasında olmuştur.

**Key words:** İkinci ürün,soya, toprak işlemesiz, damla sulama, verim

### **1. Introduction**

In 2013, soybean grain production of Turkey was 0.18 million tons. But crude soybean oil and oilseed importation of country wereover 2 million tons for the same year. For this reason, soybean acreages and production must be increased countrywide. Mardin province is located within Gap Region of Turkey and has a big potential to overcome soybean production deficit of Turkey. In the year 2014, soybean acreage in Mardin province was 1.031 ha (Tuik, 2014). Potential areas for soybean production are irrigated first and second crop areas and as Gap Project is completed, irrigatable land is expected to be increased sharply.

Conservation-tillage is reached to an important level in developed countries. But it is at low levels in Turkey and in South East Anatolia region of Turkey. Application of

conservation tillage to soybean production may reduce stubble burning, erosion and fossil fuel consumption which are among major problems for Turkish agriculture. Warmer climates and stubble burning reduces organic matter content of the soil and push soil fertility to very low levels in Turkey. No-till farming may also be a good tool to increase soybean acreage via reducing costs of fuel, mechanisation and labour.

Comparative yield levels in reduced and conventional tillage are variable and mostly depends on environmental and cultivation conditions. Yields are reduced for conservative tillage under poor drainage and high clay conditions (Griffith et al., 1988; Dick et al. 1985), under very high residue levels, cool soils and short growing seasons (Vyn et al., 1998), intolerant varieties to increased disease frequency (Adee et al., 1994) or improper weed management systems (Oryokot, 1997). Good planning will result in high yield levels (Derpsch, 1998). A proper synergistic and integrated weed, disease, insect, fertility and water management systems might be a very economic solution (Swanton, 1996).

According to conventional second crop soybean trials conducted at “GAP International Agricultural Research and Development Center” in the province of Diyarbakır in 2013, the highest grain yield of 4500 kg/ha was obtained from Atakişivariety. Atakişi was followed by Cinsoy variety with 3890 kg/ha, Umut -2002 variety with 3820 kg/ha where the lowest yield of 2040 kg/ha was obtained from Nova variety (Sevilmiş et al., 2014).

According to second crop soybean trials conducted at in the province of Şanlıurfa in 2015 and 2016, the number of physiological maturity days (FOGS), SPAD (S), NDVI (N) and canopy temperature were examined. According to research results; grain yield of soybean genotypes studied were 2266-3705 kg/ha and physiological maturity days were 104-120 (Erbil and Gür, 2017).

According to second crop soybean trials conducted at in the Aegean region of Turkey in 2015, the highest grain yield was observed from Kana (3998.3kg/ha), BATEM 317 (3893.0 kg/ha) and Kama (3671.8 kg/ha) candidate varieties by Yıldırım and Ilker, (2018). They also found that Bravo (103.7 day), ATAEM-7 ( 104.7 day) and Arısoy (106.25 day) soybean varieties and KASM 03 (106.5 day) line are the best genotypes for earliness. KASM 02 (%21.93) and BATEM 207 (%21.15) lines were superior in terms of crude oil ratio and Arısoy (%45.87) and Nova (%45.86) varieties were superior in terms of crude protein ratio for double cropping in Aegean region (Yıldırım and Ilker 2018).

Using no-till technique will also benefit regional farmers to reduce high soil temperatures at sowing time under second crop conditions to protect seeds from imbibition at

very high temperatures where farmers firstly saw seeds and then irrigate field via sprinklers to extend growing period.

## 2. Materials and Methods

Study materials are Atakisi, Cinsoy, Umut-2002, Yemsoy, Arisoy, May-5312, SA-88, Blaze and Nova (*Glycine max*) varieties; ETA1, ETA4, ETA5, ETA6 and ETA7 lines; drip irrigation system, no-till sawing machine, 18-46-0 fertilizer (18% N, 46% P<sub>2</sub>O<sub>5</sub>) and ammonium nitrate fertilizer. Trial was established in Mardin province, in a farmer field, under second crop conditions following lentil, with three replications under split-plot experimental design. Plot length was 12 m, width was 2.8 m and each plot contained 4 rows. Inter row spacing was 70 cm, intra row spacing was 3 cm. Seeds were not inoculated with *Rhizobium japonicum* bacteria. Soybean seeds were drilled via sawing machine directly into field after lentil harvest on date 23th of June 2014.

As starter fertilizer, 150 kg/ha of 18-46-0 fertilizer was banded with sawing. 300 kg/ha ammonium nitrate (33% N) fertilizer top-dressed in equal three parts via drip irrigation system. Total 127 kg N/ha and 69 kg/ha P<sub>2</sub>O<sub>5</sub> was given. The field was irrigated with sprinkler system for emergence after sawing. Rest of the irrigations has done via drip irrigation system. No soil cultivation was applied during the growing season.

Observations and measurements on plant height, number of branches per plant, number of pods per plant, number of seeds per pods were taken. Middle two lines of each plot were harvested mechanically for the grain yields on the date of 27th of October 2014. Yields, moistures and thousand grain weights were measured. Oil and protein analyzing were performed via NIT analysing equipment.

The results have been evaluated on JUMP statistical software package with LSD 5% method.

## 3. Results and Discussion

We found statistically significant differences in terms of grain yield at 14% moisture level where yields ranged between 1801 kg/ha (Blaze variety) to 3091 kg/ha (Cinsoy variety) (Table 1).

Statistically significant differences were found in terms of thousand grain weight. Thousand grain weights ranged between 119.5 g (ETA 5 line) to 153.5 g (ETA 8 line).

We found statistically significant differences in terms of oil contents where oil contents ranged between 18.5% (Yemsoy variety) to 23.3% (May 5312 variety). Statistically significant differences were found in terms of protein contents. Protein contents ranged between 36.4% (Atakisi and May 5313 varieties) to 38.8% (ETA 7 line).

**Table 1.** Grain yield, oil content, protein content and 1000 grain weight values measured in trial.

Genotype	Yield (kg/ha)	1000 grain weight (g)	Oil content (%)	Protein Content (%)
Cinsoy	3091 a	139.8 cd	21.1 c-f	38.4 ab
Atakişi	2810 ab	129.9 def	21.7 bc	36.4 d
Arisoy	2810 ab	134.6 cde	22.2 b	37.7 a-d
Umut 2002	2776 abc	152.7 ab	21.5 bcd	38.5 ab
ETA 4	2602 a-d	131.2 cde	20.8 def	36.5 d
ETA 7	2436 b-e	141.2 cd	19.5 g	38.8 a
ETA 1	2350 b-e	142.1 bc	21.8 bc	37.6 a-d
ETA 6	2340 b-e	153.1 a	20.5 ef	37.7 a-d
ETA 5	2328 b-e	119.5 f	21.3 cde	36.7 d
Yemsoy	2293 c-f	133.8 cde	18.5 h	37.8 a-d
ETA 10	2163 d-g	138.6 cd	20.4 f	38.3 abc
SA 88	2149 d-g	125.1 ef	21.9 bc	37.0 bcd
ETA 8	2060 efg	153.5 a	21.1 c-f	37.6 a-d
May 5312	1830 fg	133.7 cde	23.3 a	36.4 d
Blaze	1801 g	140.4 cd	21.9 bc	36.9 cd
Avergae	2389	137.9	21.2	37.5
CV	12.28	4.77	2.35	2.42
LSD	49.08**	10.99**	0.83**	1.52*

\* Significant at level 5%, \*\* Significant at level 1%; NS: not significant.

We found statistically significant differences in terms of the number of grains per pod where the number of grains per pod ranged between 2.7 (SA 88 and Atakisi varieties) and 3.1 (ETA 7 and ETA 10 lines) (Table 2).

There were no statistically significant differences in terms of the number of pods per plant. But we found statistically significant differences in terms of the number of branches per plant. The number of branches per plant was between 3.1 (Umut 2002 variety) to 4.7 (ETA 8 line). We found statistically significant differences in terms of plant height where plant height ranged between 72.3 cm (Blaze variety) to 138.0 cm (Yemsoy variety).

**Table 2.** Plant height, first pod height, number of branches, number of pods per plant and grain number per pod values measured in trial.

Genotype	Number of grains per pod	Number of pods per plant	Number of branches per plant	Plant Height (cm)
Cinsoy	2.8 bcd	54.7	3.9 a-d	96.7 fg
Atakişi	2.7 d	51.9	3.3 d	111.7 cde
Arisoy	2.8 bcd	45.3	3.4 cd	113.7 b-e
Umut 2002	2.9 a-d	50.0	3.1 d	122.3 bc
ETA 4	2.8 bcd	47.1	3.4 cd	109.0 def
ETA 7	3.1 a	50.5	3.7 bcd	102.7 efg
ETA 1	2.9 a-d	43.1	3.7 bcd	115.3 bcd
ETA 6	2.9 a-d	55.3	4.2 abc	103.0 d-g
ETA 5	2.9 abc	52.8	3.7 cd	109.3 de
Yemsoy	2.9 a-d	48.5	4.5 ab	138.0 a
ETA 10	3.1 a	49.5	3.7 cd	125.0 b
SA 88	2.7 d	48.3	3.8 bcd	110.7 cde
ETA 8	2.9 abc	44.5	4.7 a	93.7 g
May 5312	3.0 ab	46.7	3.9 bcd	76.3 h
Blaze	2.9 abc	44.9	3.9 a-d	72.3 h
Avergae	2.9	48.9	3.8	106.6
CV	4.7	14.1	12.7	7.1
LSD	0.2*	n.s.	0.8*	12.6**

\* Significant at level 5%, \*\* Significant at level 1%; NS: not significant.

As a result, Cinsoy, Atakisi, Arisoy, Umut-2002 varieties and ETA 4 line were well performed compared to other genotypes in the trial under no-till second crop drip irrigated conditions in Kızıltepe province of South East Anatolia region of Turkey.

It is needed to use alternative growing packages to produce higher yield levels under hot, second crop, no-till, drip irrigated conditions in Kızıltepe province. Wherefore the location is highland with high solar radiation under second crop conditions, it may be a good option to crop soybeans under narrow row with higher plant populations using short varieties in combination with bacterial inoculation to produce satisfactory yield levels to compete with second crop maize.

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