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Araştırma
(Research)

The effects of weeds control methods on yield and yield components for maize plant (*Zea mays* L.)*

Nuri YILMAZ [1*], Olgun AYDIN [2]

[1]Ordu Üniversitesi, Ziraat Fakültesi, Tarla Bitkileri Bölümü, Ordu/Türkiye
[2]Ordu Üniversitesi, Fen Bilimleri Enstitüsü, Tarla Bitkileri Anabilim Dalı, Ordu/Türkiye

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Sorumlu yazar: Nuri YILMAZ, e-posta: y_nuri@hotmail.com

Abstract

Objective: The aim of the study is to determine the effects of weeds control methods on yield and yield components of maize.

Material and Method: It was conducted with randomized blocks design with 3 replications on the maize plant at Ordu University Agriculture Faculty application area in 2019. Factors, which hoeing, mixed planting maize and bean, applying 330 g/l pendimethalin before rising, applying 47.5 % linuron before rising, applying 75 g/lt mesotrione + 30 g/lt nicosülfüron after rising, applying 40 % nicosülfüron after rising, 330 g/lt before rising and applying 75 g/lt mesotrione + 30 g/lt nicosülfüron after rising, applying 47.5 % linuron before rising and applying 40 % nicosülfüron after rising, were considered as a method of weeds control.

Results: The study had variations between ear length 7.90 – 21.33 cm, ear diameter 3.27 – 5.05, ear row number 7.33 – 14 pieces, grain number per ear 93.33 – 625.33 pieces, thousand grain weight 160.34 - 308.37 g, grain yield 239.48 – 1483.17 kg/da. There was the notable difference ($p<0.01$) in between applications as statistical.

Conclusion: The highest grain yield was obtained from herbicide applications after emergence. In the study, it was determined that the use of post-emergence herbicides is necessary in the fight against weeds in the maize plant. However, no difference was observed among the herbicides used after emergence.

Key Words: Herbicide, Yield, Maize, Weed, Yield component

Yabancı Otlarla Mücadele Yöntemlerinin Mısır Bitkisinde *(Zea mays L.)* Verim Ve Verim Ögleri Üzerine Etkileri

Öz

Amaç: Araştırma 2019 yılında yabancı otlarla mücadele yöntemlerinin mısır bitkisinde verim ve verim ögeleri üzerine etkilerinin belirlenmesi amacıyla yürütülmüştür.

Materyal ve Yöntem: Çalışma, Ordu Üniversitesi Ziraat Fakültesi uygulama arazisinde, tesadüf blokları deneme planına göre 3 tekrarlamalı olarak yürütülmüştür. Yabancı otlarla mücadele yöntemi olarak, çapalama, mısır fasülye karışık ekimi, çıkış öncesi pendimethalin, çıkış öncesi linuron uygulaması, çıkış sonrası mesotrione + nicosülfüron uygulaması ve nicosülfüron uygulaması, çıkış öncesi pendimethalin ve çıkış sonrası mesotrione + nicosülfüron uygulaması, çıkış öncesi linuron ve çıkış sonrası nicosülfüron uygulaması faktörleri ele alınmıştır.

Araştırma Bulguları: Araştırmada koçan uzunluğu 7.90 - 21.33 cm, koçan çapı 3.27 - 5.05 cm, koçanda sıra sayısı 7.33 – 14.00 adet, koçanda tane sayısı 93.33 - 625.33 adet, bin tane ağırlığı 160.34 - 308.37 g ve dekara tane verimi 239.48 - 1483.17 kg arasında değişmiş olup, uygulamalar arasında istatiksel olarak çok önemli ($p<0.01$) fark olduğu belirlenmiştir.

Sonuç: Çalışma soncunda en yüksek tane verimi çıkış sonrası herbisit uygulamalarından elde edilmiştir. Ele alınan gözlemler bakımından mısır bitkisinde yabancı otlarla mücadele de çıkış sonrası herbisit kullanımının gerekli olduğu belirlenmiştir. Ayrıca

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çıkış sonrası kullanılan herbisitler arasında herhangi bir farklılık görülmemiştir.

Anahtar Kelimeler: Herbisit, Verim, Verim ögleri, Mısır, Yabancı Ot

Introduction

The maize (*Zea mays* L.), which is included of the Gramineae *(Gramineae)* family, originated in the Americas and is thought to have a history of 8000 to 10,000 years, according to the findings obtained from the archaeological excavations.In many countries of America, Europe, Asia and Africa, it is widely grown primarily to obtain grain products, partly GreenFeed and industrial raw materials.Since it can be grown in tropical, subtropical and temperate climate zones, in almost all countries of the world, there is more or less maize farming.Today, maize can be grown anywhere in the world, except Antarctica. It can be easily grown globally between 58 North and 40 South latitudes, in areas up to 4000 meters altitude (Babaoğlu, 2005).

In 2020, maize was planted in 192 million hectares of land in the world and 1.1 billion tons (grain) of production was realized in this area. The average grain yield was 5900 kg/ha. In Turkey in 2020, 6.5 million tons (grain) of maize was produced on 640 thousand hectares of land, and the average grain yield was 1.015 kg/da, above the world average (590 kg/da). Plants, like all other living things, require the environment to be most suitable for their development so that they can grow healthy. If the conditions are not suitable, they enter a vital struggle with other cultivated plants in the field for water, nutrients, and light, which are growth factors.

According to Aldrich and Kremer (1997), weeds are defined as; “occurring in the agro-ecosystem and developing by adapting to the environment it is in, plants that harm the cultivated plant and the activities carried out with the cultivated plant in an undesirable way”. Weeds damage the yield and quality of the cultivated plant, thus reducing the profit rate of the producer. By hosting harmful insects and diseases, they also indirectly cause damage by increasing the number of tillage, irrigation, and fertilization needs.

According to another definition, weeds can also be called " Plants that grow in places where people don't want them to and cause more harm than benefit.” It has been understood that the product loss is at the level of 67.15% if the disease, pests, and weeds cause a decrease in the yield of cultivated plants such as wheat, maize, paddy, and soybean produced in the world are not combated. It is known that this is caused 21.75% by pests, 13.78% by diseases and 31.62% by weeds (Derke et al., 1994).

Maize is highly affected by the effect of weeds in the early stages of growth.

The spaces between in-row and inter-row left at the time of planting provide a very suitable environment for weed growth and these weeds often germinate and grow with the maize. In the first 4-6 weeks from sowing, maize plants complete 5% of their development, while weeds grow faster than maize and show 20% growth. By using the maize plant's water and nutrients in this way, the weeds cause in product losses. Therefore, weed control in maize is recommended during the early stages of development, when the plant's competitiveness is low (Nieto et al., 1968; Tepe, 1997). Although the maize plant is a culture plant that can compete successfully with weeds in later stages of development, it is weak in early stages of development when competing with weeds. To prevent weed problems, it is necessary to know how to control weeds first. For years, good seedbed preparation, application of various tillage methods, moving planting time forward or back, taking into account weed emergence times, crop rotation applications, variety selection, application of various fertilization techniques, and hoeing have been used as traditional weed control techniques (Tepe, 1997).

The use of herbicides in addition to modern agricultural techniques to combat weeds in agricultural products affects the cost but also causes environmental problems that arise due to unconscious use. Unconscious practices made by people who do not have sufficient knowledge increase the costs of pesticides as well as environmental pollution (Thonke, 1991).

This research was carried out to determine the effects of weeds control methods on yield and yield components of the maize plant.

Material and Methods

This research was carried out in Ordu University Faculty of Agriculture Research and Application Land in the 2019 vegetation period.

In the area where research was conducted, the climate data for the maize plant's growing season and 2019 were recorded as average temperature18.8 oC and 19.8 oC total precipitation 474.20 mm and 503.0 mm average relative humidity 74.37% and 77.92%, respectively. (Ordu Directorate General of Meteorology, 2018).

The soil in the trial area has a clayey texture, a neutral character in terms of soil response, and a modest amount of organic matter, according to the analysis results of the soil samples from the trial region. It's also less calcareous and very salty, according to the findings. It's also less calcareous and very salty, according to the findings.

Material

RX 9292 single dent corn hybrid, which are being widely grown in Ordu and its surroundings, were used as maize material in the experiment. The specified maize has a vegetation period of 130 days from the FAO 700 group.

SF 08/03 bean seeds were used as bean material. It is a mid-early and dwarf bean variety.

Used Weedkillers (Herbicides):

Herbicides applied pre-emergence and post-emergence in the trial:

1. 330 g/l Pendimethalin: Root growth inhibitor in the K1 chemical group

2. %47.5 Linuron: Photosynthesis inhibitor in C2 chemical group

3. 75 g/l Mesotrione + 30 g/l Nicosulfuron: Pigment inhibitor in F2 Chemical group and acetolactate synthetase (ALS) enzyme inhibitor in B Chemical group

4. 40 g/l Nicosulfuron: Acetolacto synthetase (ALS) enzyme inhibitor in chemical group

Method

Soil cultivation was carried out at a depth of 20-25 cm in the experimental area to improve the effects of primary elements such as water, air, temperature, and nutrients essential for perfect plant growth and development and to eliminate competition with weed management.

It was reworked at a depth of 10 cm to prepare, loosen and thin the seedbed before planting, as well as to remove plant residues and weeds from the previous season.

The trial was established on May 22, 2019, with 3 replications according to randomized blocks design.

A plot size of 2.8 m x 4 m having 4 rows, 70 cm apart was used. Sowings in a row was 20 cm of spacing and the distance between plots was 1 m. In the mixed planting plot, 4 rows of beans were planted between the maize rows, with a distance of 30 cm in the rows.

According to the soil analysis results, nitrogen and phosphorus were applied at rates of 10 kg N/da and 10 kg P_2O_5/da. Half of the nitrogen was given with the planting, the other half was given at 5-6 leaf stage, and the whole of the phosphorus was given with the planting. Ammonium nitrate and triple superphosphate fertilizers were used as nitrogen and phosphorus sources.

In all plots, taking into account the soil moisture, the first irrigation was done regularly with the sprinkler irrigation system at the period, when the plants were approximately 20 cm (4-5 leaves) tall. In addition, irrigation was carried out with the same method at stages of tasseleing, pollination and grain filling periods.

Applications

1. Control: During the growing period of maize, no other application was made other than the cultural processes that were applied equally to all plots.

2. Hoeing: On June 15, 2019, and on July 07, 2019, when the plants grew 40-50 cm, weeds were killed and removed with a hand hoe.

3. Intercropped Maize and Soybean: 4 rows of beans were planted between the rows of the maize plant (with a distance of 30 cm over rows).

4. Pre-emergence (1) Weed Killer 330 g/l Pendimethalin Application: After planting, on May 25, 2019, a pre-emergence herbicide containing 330 g/lt Pendimethalin was applied as 500 ml/da.

5. Pre-emergence (2) Weed Killer 47.5% Linuron Application: After planting, on 25 May 2019, a pre-emergence herbicide with 47.5% Linuron active ingredient was applied at 250 g/da.

6. post-Emergence (1) Weed Killer 75 g/lt Mesotrione + 30 g/lt Nicosulfuron Application: After emergence, on 09 June 2019, an herbicide with 75 g/lt Mesotrione + 30 g/lt Nicosulfuron active ingredient was applied in the 4-5 leaf stage of maize at 200 ml/da.

7. post-Emergence (2) Weed Killer 40% Nicosulfuron Application: After emergence, on 09 June 2019, the herbicide with 40% Nicosulfuron active ingredient was applied in the 4-5 leaf stage of maize at 125 ml/da.

8. Pre-emergence 330 g/lt Pendimethalin and Post-emergence 75 g/lt Mesotrione + 30 g/lt Nicosulfuron Herbicide (1) Application: On 25 May 2019, a pre-emergence herbicide with 330 g/lt Pendimethalin active ingredient was applied, on 09

June 2019, on 4-5 leaf stage of corn, a post-emergence herbicide with 75 g/lt Mesotrione + 30 g/lt Nicosulfuron active ingredient was applied as 200 ml/da.

9. Pre-emergence 47.5% Linuron and Post-emergence 40% Nicosulfuron Herbicide (2) Application: On 25 May 2019, a pre-emergence herbicide with 47.5% Linuron active ingredient was applied, on 09 June 2019, a post-emergence herbicide with 40% Nicosulfuron active ingredient was applied in the 4-5 leaf stage of corn at 125 ml/da.

On September 28, 2019, when the plants reached physiological maturity, 50 cm from the plots beginnings and one row of edges from the parcel plot edges were discarded as an edge effect. Observations and measurements were made on the plants in the remaining areas.

Features Examined in the Research

In this study, in which the effects of the techniques applied in weed control and herbicide chemicals on the yield and yield components of the maize plant were examined, observations and measurements were made on 10 randomly selected ears.

In the research, ear length (cm), ear diameter (cm), the row number of the ear (number), grain number of the ear (number), 1000 grain weight (g), and grain yield (kg/da) were investigated.

The data obtained from the study were analyzed by using the SAS-JMP-5.01 statistical package program according to the randomized bocks design. LSD multiple comparison method was used to compare the differences between the means showing significance.

Results and Discussion

Weeds growing in the application area are given in Table 1. Species determinations were made on Herbarium specimens in the laboratory of the Department of Biology, Faculty of Education, Ordu University. Classification and evaluation of the weeds seen were made according to the Technical Instruction to Combat Maize Integrated.

Table 1. Weeds Detected

No.	Latin Name	Turkish Name	Family	Leaf	Year
1	*Chenopodium album L.*	Sirken	*Chenopodiaceae*	Broad Leafy	Annual
2	*Xanthium strumarium L.*	Domuz Pıtırağı	*Compositae*	Broad Leafy	Annual
3	*Polypogon monspeliensis (L.) Desf.*	Yıllık Sakal Otu	*Poaceae*	Narrow-Leaved	Annual
4	*Echinochloa crus galli (L.) P.B.*	Darıcan	*Gramineae*	Narrow-Leaved	Annual
5	*Convolvulus arvensis L.*	Tarla Sarmaşığı	*Convolvulaceae*	Broad Leafy	Perennial
6	*Cynodon dactylon (L.) pers.*	Köpekdişi	*Gramineae*	Narrow-Leaved	Perennial
7	*Artemisia vulgaris L.*	Yabani Pelin	*Compositae*	Broad Leafy	Perennial
8	*Solanum nigrum L.*	Köpek Üzümü	*Solanaceae*	Broad Leafy	Annual
9	*Sigesbeckia orientalis*	Sarıteçan	*Asteraceae*	Broad Leafy	Annual
10	*Equisetum arvense L.*	Tarla At Kuyruğu	*Equisetaceae*	Narrow-Leaved	Perennial
11	*Polygonum lapathifolium L.*	B. Çoban Değneği	*Polygonaceae*	Broad Leafy	Annual

As can be seen from the table 1, 4 of the weeds detected in the trial area are perennial and 7 of them are annual. In addition, 4 of them are narrow-leaved and 7 of them are broad-leaved.

Whether weeds are annual or perennial, broad or narrow-leaved, and their propagation patterns are very important in the fight.

Klein et al., (1994) reported that hoeing or hand plucking was effective in the fight against small and annual weeds, but these methods did not go beyond a short-term effect against perennial weeds, and herbicide applications were important to get more efficient results.

Also, Nieto et al. (1968) stated that herbicide application alone is not sufficient due to weed characteristics.

Ear length: After the ear husks were peeled, the section from the bottom of the ear to the tip was measured in cm. Ear length averages and statistical groups related to trial factors are given in Table 2. As can be seen from the table, it was found that the effect of weed control practices on ear length was statistically significant (P<0.01).

Table 2. Averages of Ear Length and Ear Diameter in Corn (cm)

Applications	Ear Diameter	Ear Length
Control	3.88 bcd	12.17 b
Hoeing	3.53 cd	11.81 b
Intercropped Maize and Soybean	3.27 d	7.90 c
Pre.E.1 (330 g/l Pendimethalin)	3.44 cd	11.85 b
Pre.E.2 (%47.5 Linuron)	3.97 bc	14.21 b
Post.E.1(75g/ltMesotrione+30 g/lt Nicosülfüron)	4.85 a	20.36 a
Post.E.2 (%40 Nicosülfüron)	4.51 ab	18.80 a
Pre.E.+ Post.E.1 (330 g/lt Pendimethalin)+(75 g/lt Mesotrione + 30 g/lt Nicosülfüron)	5.05 a	21.33 a
Pre.E.+ Post.E.2 (%47.5 Linuron)+(%40 Nicosülfüron)	4.99 a	21.03 a
Average	4.16	15.50

In study, the ear length varied between 7.90 cm and 21.33 cm and average of the ear length was 15.50 cm.

The highest ear length was obtained from pre-emergence 330 g/lt pendimethalin and post-emergence 75 g/lt mesotrione + 30 g/lt nicosulfuron herbicide application. However, the differences in spike length between this application and applications 6, 7 and 8 were not significant.

The lowest ear length was obtained from the mixed planting application (Table 2). It was observed that herbicides applied after emergence have a significant effect on the increase of ear length.

Öktem et al. (2004) and Gökgöz (2010) reported that the values of the longest ear in their studies were obtained with hoeing and herbicide applications.

It is seen that there is a partial similarity between our findings and the results of the researchers mentioned. Likewise, in our results, high results could not be obtained without hoeing. It is thought that this is due to the application difference in the trials and the ecological environment difference.

On the other hand, Pannacci and Covarelli (2009), Güngör (2005) and Klein et al. (1994) stated that the effectiveness of post-emergence herbicides was higher in maize. It is seen that our findings are in agreement with the results of the related researchers.

Ear diameter: About 1/3 of the bottom of the ear was measured with a caliper and recorded in cm. Averages and statistical groups of ear diameter obtained from the experiment are given in Table 2.

The applications of weed control statistically had very significant effect on ear diameter ($P<0.01$).

The diameter obtained from the experiment varied between 3.27-5.05 cm and average value was measured as 4.16 cm on average.

The highest ear length was obtained from pre-emergence 330 g/lt pendimethalin and post-emergence 75 g/lt mesotrione + 30 g/lt nicosulfuron herbicide application. However, Pre.E.+Post.E.2 (47.5% Linuron) +(40% Nicosulfuron), Post.E.1 (75 g/lt Mesotrione + 30 g/lt Nicosulfuron) and Post.E.2 (40% Nicosulfuron)) applications are in the same importance group statistically. the lowest ear diameter was in the application of intercropped as 3.27 cm (Table 2).

While Öktem et al. (2004) obtained the highest value of ear diameter from hoeing and herbicide applications, Gökgöz (2010) also obtained from hoeing. In our findings, it was seen that sufficient performance for weed control could not be obtained without hoeing.

It is thought that the difference between studies is due to agronomic practices.

The row number of the ear: Grain row is calculated from the bottom 1/3 of the ear. Averages and statistical groups regarding the number of rows on the ear are given in Table 3.

As it can be seen from the table 3, the effect of weed control practices on the number of rows on the cob was statistically very significant ($P<0.01$).

The number of rows on the ear in the experiment varied between 7.33 and 14.00, and the average was determined as 10.96.

The highest number of rows on the ear was obtained from post-emergence herbicide applications as 14.00.

The lowest number of ear rows were found at appllications of Intercropped and hoeing, and that applications were in the same statistical group with pre emergence (330 g/l Pendimethalin) application and control (Table 3).

Regarding the subject, Öktem et al. (2004) obtained the maximum number of rows on the cob from herbicide application as similar to our results. Gökgöz (2010), on the other hand, reported that the highest number of rows on the ear was from hoeing.

Table 3. Averages of The Row Number of Ear and The Grain Number of Ear

Applications	Row Number in Ear	Grain Number of Ear
Control	8.00 c	157.33 d
Hoeing	7.33 c	167.33 d
Intercropped Maize and Soybean	7.33 c	93.33 d
Pre.E.1 (330 g/l Pendimethalin)	8.00 c	144.00 d
Pre.E. 2 (%47.5 Linuron)	12.00 b	300.00 c
Post.E.1(75g/ltMesotrione+30 g/lt Nicosülfüron)	14.00 a	578.67 ab
Post.E.2 (%40 Nicosülfüron)	14.00 a	508.67 b
Pre.E.+ Post.E.1 (330 g/lt Pendimethalin) + (75 g/lt Mesotrione + 30 g/lt Nicosülfüron)	14.00 a	625.33 a
Pre.E.+ Post.E.2 (%47.5 Linuron) + (%40 Nicosülfüron)	14.00 a	616.00 a
Average	10.96	354.51

The grain number of ear: It was calculated by multiplying the row number of the ear by the number of seeds in the row. Averages and statistical groups regarding the grain number of the ear are given in Table 3.

The effect of weed control practices on the grain number of the ear was found to be statistically very significant ($P<0.01$). The average grain number of ears obtained from the experiment varied between 93.33 and 625.33, and the average was determined as 354.51 grain/ear.

Among applications, the maximum grain number of ears was obtained from the application of Pre.E+Post.E.1 (330 g/lt Pendimethalin)+(75 g/lt Mesotrione + 30 g/lt Nicosulfuron) and This application is in the same statistical significance group as with Pre.E+Post.E.2 (47.5% Linuron)+(40% Nicosulfuron) application.

Intercropped (Maize and Soybean) had the lowest value for the grain number of the ear and it was in the same statistical group with control, hoeing and Pre.E.1 (330 g/l Pendimethalin) applications (Table 3).

Öktem et al. (2004), and Gökgöz (2010) obtained the highest grain number of the ear from herbicide applications and the lowest from control. Our findings were found to agree with the results of some other researchers.

1000 -grain weight: Averages and statistical groups for thousand-grain weights are given in Table 4.

The effect of weed control practices on thousand grain weight was found to be statistically significant ($P<0.01$). The thousand-grain weights of the applications in the experiment varied between 160.34 g and 308.37 g, and the average was determined as 239.98 g.

It was observed that the highest thousand-grain weights were at intercropped and hoeing applications, and the lowest thousand-grain weight was at the pre-emergence herbicide 47.5% linuron application (Table 4). This is the expected result because the grain number of ears and the weight of a thousand grains are inversely proportional to each other. In our study, it was found that the lowest grain number of the ear was at hoeing and intercropped applications.

Regarding the subject, Öktem et al. (2004), in their study, the highest thousand grain weight was obtained from the herbicide application. Gökgöz (2010) stated that they got it from hoeing and herbicide applications. The difference between studies is thought due to ecological factors and differences in agronomic practices.

Table 4. Averages of Grain Yield (kg/da) and Thousand Grain Weight (g)

Applications	Grain Yield 1000	Grain Weight
Control	363.63 cd	199.21 cd
Hoeing	343.80 cd	306.93 a
Intercropped Maize and Soybean	131.78 d	308.37 a
Pre.E.1 (330 g/l Pendimethalin)	239.48 cd	214.40 bc
Pre.E. 2 (%47.5 Linuron)	527.60 bc	160.34 d
Post.E.1(75g/ltMesotrione+30 g/lt Nicosülfüron)	1483.17 a	238.70 bc
Post.E.2 (%40 Nicosülfüron)	737.90 b	254.28 b
Pre.E.+ Post.E.1 (330 g/lt Pendimethalin) + (75 g/lt Mesotrione + 30 g/lt Nicosülfüron)	1302.74 a	255.31 b
Pre.E.+ Post.E.2 (%47.5 Linuron) + (%40 Nicosülfüron)	1304.99 a	222.31 bc
Average	715.01	239.98

Grain Yield: After removing the edge areas from the plots, the remaining parts were harvested, the moisture determination of the granulated grains was made, and the yields were calculated by converting them to decares (arranging according to 15% humidity). Averages and statistical groups related to the grain yield are given in Table 4. The effect of weed control practices on grain yield statistically significant ($P<0.01$).

The grain yields in research varied between 131.78 kg and 1483.17 kg, and an average yield of 715.01 kg/da was obtained. The highest grain yield was obtained from Post.E.1 (75 g/lt Mesotrione + 30 g/lt Nicosulfuron) application.

However, there was no significiant difference between this apllication and Pre.E.+ Post.E.1 (330 g/lt Pendimethalin)+(75 g/lt Mesotrione + 30 g/lt Nicosulfuron) and Pre.E.+ Post.E.2 (47.5% Linuron)+(% 40 Nicosulfuron) applications (Table 4).

The lowest grain yield was obtained from the intercropped application.

However, intercropped application was in same statistical group with control, hoeing and pre-emergence herbicide applications.

The researchers such as Gökgöz (2010), Öktem et al. (2004), Klein et al. (1994), Ozer et al. (1998), Berzseny et al. (1995), Pannnacci and Covarelli (2009) reported that post-emergence herbicide applications increased the yield, similar to our findings. In addition, while Güngör (2005) reported applications of pre-emergence and post-emergence herbicide increased the yield of the maize plant, Skrzypczak and Pudelko (1993) stated that pre-emergence herbicide application increased the yield of the maize plant.

On the other hand, Nieto et al. (1968) found that herbicide applications alone were not sufficient to combat weeds, Johnson et al. (2001) suggested that integrated control should be done against weeds in maize cultivation such as rotation, other cultural measures and, if necessary, herbicide application.

Thonke (1991), on the other hand, stated that uncontrolled and excessive use of herbicides will cause environmental problems, that it may damage the structure of the soil by damaging other living organisms and this situation will cause production problems in the long run. In addition, that misusing will cause pollution of groundwater or cause human health problems because of residues. It has been reported that the use of herbicides should be controlled for all these reasons.

Conclusion

Considering the frequency of occurrence in all plots, the first 5 weed species were determined as, *Echinochloa crus galli (L.) P.B.* (darıcan), *Polypogon monspeliensis (L.) desf.* (yıllık sakal otu), *Cynodon dactylon (L.) pers.* (köpekdişi), *Xantium strumarium L.* (domuz pıtırağı) ve *Chenopodium album L.* (sirken), respectively. It was determined that ear length, ear diameter, the row number of the ear, grain number of ear, 1000 grain weight, and grain yield, were negatively affected by weeds. In terms of the observed observations, it was found that the use of post-emergence herbicides is necessary for the fight against weeds in the corn plant. However, no difference was observed among the herbicides used after emergence. It was determined that pre-emergence herbicide use did not have any effect on weed control in the maize plant. It was observed that hoeing and manual weeding control perennial weeds for a short time, but their effectiveness was not permanent throughout the vegetation period. Effectiveness of intercropped of the bean, a legume, with maize as a method of weed control did not appear promising. However, it is recommended for researchers to apply different row spacings, different densities, or with different planting methods.

As a result, besides preventing yield loss in corn, weed control should be done to leave a clean field for the next season. Like all other applications, the aim of weed control is to get high and quality product with the least cost.

Although the effectiveness of herbicide applications in the fight against weeds is a known fact, the main thing is to use products and techniques that will not harm the environment and other living things in the ecosystem. For this reason, it is recommended to use the products in accordance with the instructions and in appropriate doses.

Conflicts of Interest

The authors declare no conflicts of interest.

Authorship contribution statement

NY: He contributed to the supply of materials for the research, planning the experiment, statistical interpretation of the data and writing the article.

OA: He contributed to the establishment and conduct of the experiment, the performance of laboratory studies, the acquisition and evaluation of data.

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