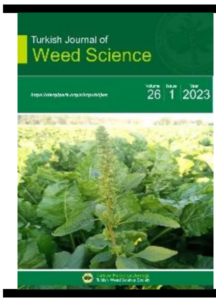

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Araştırma Makalesi/Research Article

Determination of the Weed Flora and the Efficacy of Some Herbicides on Weeds and Yield in Maize Fields of Iğdır Province, Türkiye

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ABSTRACT

Maize is a very important food crop worldwide. Weed surveys and effective weed management practices are crucial for maintaining high crop yields and quality. The aim of the study was to assess the distribution and relative abundance of weed species in maize production areas of Igdir Province and evaluate the effectiveness of different herbicides in controlling weeds and improving maize yield. The experiment employed a Completely Randomized Block Design, consisting of 7 treatments with 4 replications. The treatments included 330 g/l pendimethalin, 225 g/l isoxaflutole + 90 g/l thiencarbazone methyl + 150 g/l cyprosulfamide, %25 tritosulfuron + %50 dicamba, 452.42 g/l 2,4-D EHE + 6.25 g florasulam, 40 g/l nicosulfuron, and two check treatments, namely weed-free and weedy check. In total, 50 survey sites were visited during the months of June and July in Iğdir Center (34) and its districts Karakoyunlu (13), Aralık (2), and Tuzluca (1), based on the maize production areas in 2017. The surveys revealed the presence of 25 weed species belonging to 11 families in the maize fields. Therefore, the conducted survey of the maize fields in Igdir Province identified 25 weed species belonging to 11 different families. The top three largest families found in the maize fields were Poaceae (8 species), Fabaceae (4 species), and Asteraceae (3 species). Among the weed species identified, 13 of them were found to have a frequency of more than 10 percent. The top 5 species determined in terms of frequency were *Sorghum halepense* (L.) Pers. (94%), *Portulaca oleracea* L. (68%), *Xanthium strumarium* L. (62%), *Amaranthus retroflexus* L. (38%), *Convolvulus arvensis* L. (28%). The evaluation of maize yield and its components, such as the number of rows of cobs, the length and diameter of the cob, the height of the plant, and the thousand grain weight, showed a significant increase in all treatments compared to the weedy check. The percentage increase in these yield component results showed a 98% increase in the yield, a 31.3% increase in the number of rows of cobs, a 38.5% increase in the length of the cob, a 19.8% increase in the diameter of the cob, a 66.2% increase in the height of the plant, and a 64,8% increase in the thousand grain weight. The increase in the thousand grain weight suggests that the herbicides may have also helped to improve the overall quality of the maize crop. The results of this study provide valuable information for developing effective weed management strategies that can help to improve maize yield and quality in the region.

Keywords: *Zea mays* L., herbicide, weeds, survey, control

1. INTRODUCTION

Maize (*Zea mays* L.) is a highly significant cereal crop worldwide, widely utilized for various purposes. In addition to its use as a human food, maize is also an important source of animal feed and is used in the production of biofuels such as ethanol (Green et al.2018). Maize is a highly versatile crop that can be grown in a variety of agroecological zones and has a high tolerance to drought and other environmental stresses. It is also a relatively low-cost crop to produce, making it an important source of income and food security for millions of people around the world. Due to its importance as a staple crop (Smith et al. 2004), there is ongoing research to improve the yield and nutritional quality of maize, as well as to develop more sustainable and environmentally-friendly production methods. Overall, maize plays a vital role in the global food system and is likely to remain an important crop for years to come (Erenstein et al. 2022). Maize production has been steadily increasing over the years, with the world production reaching about 1 billion 162 million tons in 2020 according to the Food and Agriculture Organization of the United Nations (FAO, 2021). In Türkiye, maize is the second most important cereal crop after wheat, with an approximate production of 7 million tons in recent years (TÜİK, 2022). As the world's population continues to grow, there is a pressing need to ensure that there is enough food to meet the nutritional needs of people (Daniel et al., 2022). One crucial aspect of this is increasing plant production, as plants are the primary source of food for most people. One possible approach to achieve this is managing plant protection problems, including weeds, is an essential aspect of crop production that affects yield and quality (Kalogiannidis et al., 2022). Weeds can compete with crops for resources such as nutrients, light, and water, which can reduce crop yield and quality. Weeds can also serve as hosts for pests and diseases, which can further damage crops(Swinton, Deynze. 2017; Tepe, 1998; Gharde et al., 2018; Jabran and Chauhan, 2018). According to Güncan and Karaca (2018), the amount of crop loss or reduced yield reported may be influenced by factors such as the cultivars and geographical regions where the crops are grown. Various studies have demonstrated that numerous species of annual and perennial weeds can have detrimental impacts on the yield of maize (Mennan and Işık, 2003; Zhang et al., 2013; Tesfay et al., 2014; Tursun et al., 2016; Hançerli and Uygur, 2017; Böcker et al., 2018; Mitkov et al., 2019; Kakade et al., 2020; Landau et al., 2021 Delchev, 2022; Alptekin et al. 2023). Oerke and Dehne (2004), reported a 37% decrease in maize production when grown under weed pressure. Weed control is essential during the early stages of maize growth, regardless of whether the plant is being grown for grain or silage. During this period, weeds can significantly impact plant development, potentially leading to insufficient root growth in fields with high weed density. At this stage, it is crucial to undertake any necessary actions to control weeds, as failure to do so could have significant impacts on crop yield (Güncan and Karaca, 2018). Achieving higher maize productivity is a significant challenge, largely due to the difficulty of controlling and managing weed growth. Despite the availability of mechanical control methods, their implementation in maize plantations is frequently hindered by high labor costs and limited economic feasibility (Güngör, 2005; Şahin and Kadıoğlu, 2021). The management of perennial weeds presents a significant challenge, as hand weeding and hoeing are generally less effective in controlling these types of weeds. To achieve better results, the use of herbicides has been recommended as a more suitable approach for managing these persistent weeds (Imoloame, 2017; Absy, 2019; Idziak et al., 2022). In maize cultivation areas, chemical control methods are often favored over other options due to the significant labor and cost constraints. These methods offer fast, reliable results, are easy to apply, and tend to be more cost-effective (Kitiş, 2011; Idziak et al., 2022). Herbicides are among the most widely used and effective methods for weed management. However, in order to obtain the desired results from herbicide application, it is crucial to use the appropriate herbicide at the appropriate time and dosage (Yavuz et al., 2017). Knowing the biology and characteristics of various weed species is a key factor in effectively managing and controlling weeds (Özer et al., 2001). Effective control of weeds through chemical means requires several key elements to be in place. These include accurate identification of the target weed species, selection of the appropriate herbicide that specifically targets that species, application of the herbicide at the optimal time in the weed's growth cycle, use of the correct dose of herbicide, and proper application technique. Employing all of these factors in a comprehensive weed control strategy can lead to successful management of weed populations. However, it's important to note that chemical control should be integrated with other methods of weed control for long-term, sustainable management of weeds (Harker, & O'Donovan, 2013; Kudsk and Streibig, 2003). The current study was conducted in order to assess the distribution and abundance of weed species and their frequencies, general coverage, special coverage, geneal densities, special densities in maize production areas in Igdir Province, and to evaluate the efficacy of various herbicides in controlling weeds and enhancing maize yields. Therefore, identifying the weed species present in the area and selecting the most effective herbicide treatment is critical for successful maize production. The study likely involved field surveys to determine the weed species present in the maize fields in Igdir Province, as well as herbicide trials to evaluate the efficacy of different herbicides in controlling the weeds. The study likely measured the relative abundance of each weed species before and after herbicide application, and assessed the impact of herbicides on maize yield. The findings of the study could be used to develop weed management strategies for maize production, which could help farmers increase their crop yields and profitability.

2. MATERIALS AND METHODS

Field experiments were conducted during April to August in 2017 under field conditions (Melekli, Iğdır, Türkiye; 399458 N-440974 E). The soil characteristics of the experimental area were as follows: slightly salty (2 mmhos cm^{-1}), pH: 7.9, organic matter content (1.8%, medium), medium lime (6.58%), phosphorus content (8,2 P_2O_5 kg ha^{-1} ; high), clay-loam, and potassium (3.45 K_2O kg ha^{-1} , rich). The weather conditions of the experimental location for the period of April-August in 2017 were shown in the Table 1.

Table 1. The weather conditions of the Iğdır province (Anonymous, 2017)

Months	Average Temperature (°C)	Total Rainfall (mm)
April	12.2	17.8
May	16.5	40.6
June	23	26.5
July	28	0
August	27	0

The Seeds of Korimbos (KWS Türk Tarım Tic. A.Ş.) maize variety were used for the study in the trials. Seeds were sown at a rate of 25 kg per hectare, with an inter-row distance of 70 cm and an intra-row distance of 20 cm. With planting 450 kg of zinc+20+ 20 + 20 (NPK) fertilizers were applied per hectare. Forty five days after planting 350 kg of urea (46% N) fertilizers were applied per hectare. After the sowing, the first irrigation was done with the sprinkler irrigation method and a total of eight subsequent irrigations were carried out using the furrow irrigation method taking into account the plant water demand. Only 330 g/l Pendimethalin(Status 330 EC) was used as pre-emergence and four post-emergence herbicides were used in the study; namely 225 g/l Isoxaflutole + 90 g/l Thiencarbazone methyl +150 g/l Cyprosulfamide (Adengo SC 465), %25 Tritosulfuron +%50 Dicamba (Arrat), 452.42 g/l 2,4-D EHE + 6.25 g/l Florasulam (Mustang), 40 g/l Nicosulfuron (Sanson). All herbicides were used at recommended license doses (Table 2).

Table 2. Active ingredients, mode of action, formulations, dose, and application time

Treatments	**MOA***	**Formulation****	**Doses**	**Application time*****
330 g/l Pendimethalin	K1	EC	5000 mL/ha	PreE
225 g/l Isoxaflutole + 90 g/l Thiencarbazone methyl+150 g/l Cyprosulfamide	F2	SC	350 mL/ha	PostE
%25 Tritosulfuron + %50 Dicamba	B, O	WG	250 g/ha	PostE
452.42 g/l 2,4-D EHE+ 6.25 g/l Florasulam	O, B	SE	700 mL/ha	PostE
40 g/l Nicosulfuron	B	OD	1250 mL/ha	PostE
Weed free control				
Weedy control				

*MOA: Mode of action; HRAC Mode of Action Classification 2020 (Anonymous, 2020) K1: Inhibition of microtubule assembly; F2: Inhibition of HPPD; B: Inhibition of ALS; O: Auxin mimics; **EC: Emulsifiable Concentrate; SC: Suspension Concentrate; WG: Water-dispersible Granule; SE: Suspoemulsion; OD; oil dispersion; ***PreE: Pre-emergence; PostE: Post Emergence

The experiment was comprised of twenty-eight plots, each with an area of $25m^2$ (5m x 5m), and arranged according to a randomized complete blocks design with four replications and seven experimental groups (including five different herbicides, a weed-free control, and a weedy control) (see Figure 1). The distance between each treatment and replication was 1m (see Figure 1). The pre-emergence herbicide was 2 days, post-emergence herbicides 23 days after sowing were applied using a back sprayer equipped with a 25-L tank capacity, gasoline engine, and fan nozzles with a pressure of 3 atm and and 5 meters spray width. In the weed-free control plots, hoe and hand weeding were utilized. Weedy control plots were left as they are.

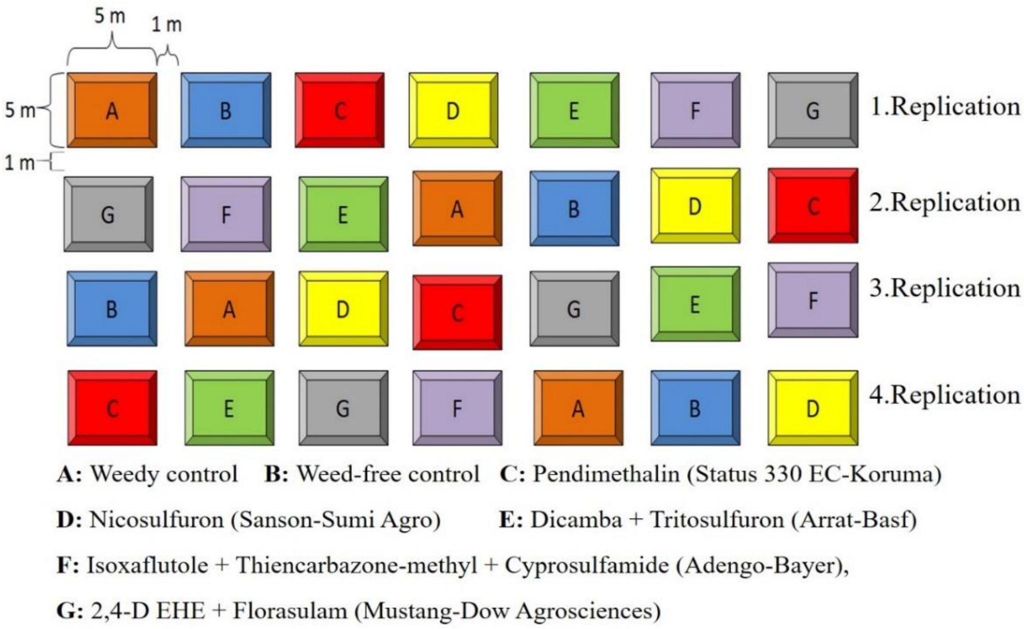


Figure 1. Experimental design.

The surveys were conducted in the districts of Iğdır Centre, Karakoyunlu, Aralik, and Tuzluca in order to determine the weed species that are a problem in maize production areas. The surveys were conducted by taking into account the total cultivation areas on a district-by-district basis. During the vegetation period of 2017, a total of 50 maize fields were visited in Iğdır Centre and its districts. The weed species and their densities were noted prior to the trials. As part of this aspect, a 1 m^2 frame was utilized in the experimental area, which was randomly repositioned. The species of weeds, their growth stages, and the number of each weed species present within the covered area or m^2 were recorded. The densities of each weed species were then determined using the following equation (Odum, 1971).

$$\text{Density (plants/m}^2\text{)} = B/m,$$

The total number of individual plants in the samples was denoted as "B", while the total number of meters was represented as "m". Each of these parameters was determined individually. The frequency formula is calculated as follows (Odum, 1971):

Frequency (%) (F) = Number of surveyed fields where a species occurred / number of total surveyed fields X 100

General coverage (%) (GC) = Coverage of a weed species in surveyed fields / number of total surveyed fields

Special coverage (%) (SC) = Coverage of a weed species where a species occurred / number of total surveyed fields

General density (plants/m^2) (GD) = Number of each weed species in m^2 / number of total surveyed fields

Special density (plants/m^2) (SD) = Number of each weed species where a species occurred in m2 /number of total surveyed fields.

The plants were harvested on 22 August 2017. In order to assess the yield parameters, grain yield, plant height, kernel rows, cob length, cob diameter, and 1000-grain weight were recorded in ten maize plants for each replication (Sönmez et al., 2013). The effect of herbicide application on yield and yield parameters was evaluated by comparing treated plots with weed-free and weedy plots. One-way analysis of variance was performed on the relevant data. Statistical comparison of means was carried out by Duncan's multiple range test with a significance level of $p < 0.05$ using SPSS 22.

4. RESULTS AND DISCUSSION

4.1. Weed survey results

As a result of a total of 50 survey in maize fields, 25 weed species belonging to 11 plant families were found. Considering the number of species of these weeds, the largest family was Poaceae with eight species, followed by Fabaceae with four species and Asteraceae with three species. In addition, the number of weed species owned by the families is given in Figure 2.

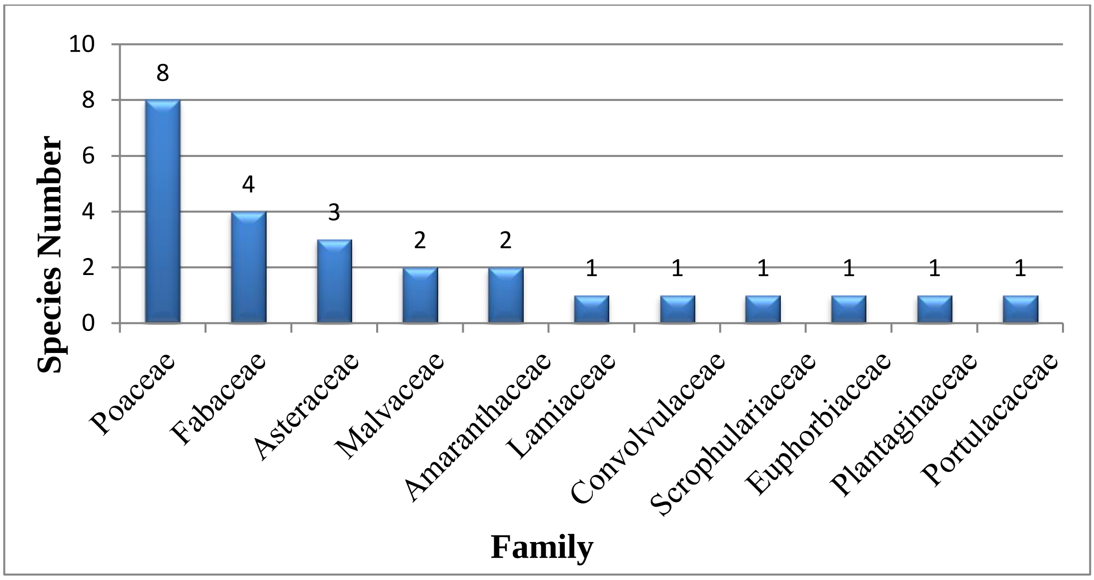


Figure 2. Distribution of weed species in maize fields according to families

A list of all the weed species detected in the maize cultivation areas in alphabetical order in Table 3. The table includes information on the percentage frequency of each weed species, as well as the percentage of general and special coverage areas. Additionally, the table provides information on the general and special densities of each weed species, measured in plants per square meter. This information can be used to understand the relative abundance and distribution of different weed species in the maize cultivation areas, which can help inform weed management strategies to minimize their impact on crop yield and quality.

Table 3. Weed species, their frequencies and densities in maize fields of Iğdır

Weed species	F %	GC %	SC %	GD	SD
Abutilon theophrasti Medicus	14	0.22	1.57	0.285	3.00
Agropyron repens (L.) Beauv.	4	0.12	3.00	0.130	6.50
Amaranthus retroflexus L.	38	0.48	1.26	0.820	3.56
Chenopodium album L.	16	0.58	3.62	0.305	3.05
Cirsium arvense (L.) Scop.	14	0.48	3.42	0.085	1.30
Convolvulus arvensis L.	28	1.70	6.07	0.495	4.12
Cynodon dactylon (L.) Pers.	2	0.10	5.00	0.075	7.50
Digitaria sanguinalis (L.) Scop.	6	0.06	1.00	0.110	3.66
Echinochloa crus-galli (L.) P.Beauv.	4	0.30	7.50	0.070	3.50
Euphorbia helioscopia L.	2	0.02	1.00	0.025	2.50
Glycyrrhiza glabra L.	18	0.18	1.00	0.210	2.33
Hibiscus trionum L.	26	0.42	1.61	0.785	4.36
Lactuca serriola L.	6	0.22	3.66	0.120	3.42
Marrubium vulgare L.	4	0.08	2.00	0.045	2.25
Medicago polymorpha L.	6	0.14	2.33	0.145	4.83
Medicago sativa L.	4	0.40	10.00	0.085	5.66

Phalaris arundinacea L.	2	0.02	1.00	0.010	1.00
Plantago lanceolata L.	2	0.02	1.00	0.025	2.50
Portulaca oleracea L.	68	14.60	21.47	9.105	15.30
Setaria verticillata (L.) P. Beauv.	22	0.22	1.00	1.050	6.77
Setaria viridis (L.) Beauv.	16	0.16	1.00	0.510	5.36
Sophora alopecuroides L.	14	0.14	1.00	0.255	3.00
Sorghum halepense (L.) Pers.	94	16.32	17.36	24.240	26.34
Veronica officinalis L.	8	0.08	1.00	0.060	2.40
Xanthium strumarium L.	62	6.10	9.83	2.115	5.22

F: Frequency, **GC:** General coverage, **SC:** special coverage, **GD:** general density, **SD:** special density

The frequency of 13 species were found over 10% a result of the surveys. Top five species were; *Sorghum halepense* (L.) Pers. (94%), *Portulaca oleracea* L. (68%), *Xanthium strumarium* L. (62%), *Amaranthus retroflexus* L. (38%), *Convolvulus arvensis* L. (28%). Similar weed species were found by Şahin et al. (2020) in cotton production areas of Iğdır province nearly in the same order. There is a similarity between the weeds found in the surveys conducted by Arslan (2018) in corn fields and the weeds found in the current study based on frequency of weeds. It is possible that the similarity between the weed populations in the two studies could be due to a number of factors, such as similar environmental conditions, planting and management practices. We observe a similar outcome in Güngör's (2005) study in maize fields.

4.2. Weed species in experimental area

The experimental area established at the Agricultural Application and Research Center of Iğdır University had a population of more than one plant per square meter for each of the six distinct weed species present during tassel period in maize. Among these weed species *S. halepense* was the dominat weed species with a density of 37,54 (plant/m2) followed by *S. verticillata* (Table 4), both are narrow-leaved weeds. Tülek et al.(2022) reported similar dominant weed species (*S. halepense*, *X. strumarium* and *C. album*) in the experimental area in both years which were established in the same Agricultural Application and Research Center of Iğdır University. At the same time, Koç and Karaca (2022) reported that the 3 most intense weed species in maize experimental plots were *A. retroflexus*, *C. album* and *X. strumarium*, respectively.

Table 4.Weed species and their densities (plant/m^2) in weedy plots during tassel period in maize

Common names	**Scientific names**	**Densities (plant/m^2)**
Johnson grass	*Sorghum halepense* (L.) Pers.	37.54
Bristle pigeon grass	*Setaria verticillata* (L.) P. Beauv.	18.95
Common cocklebur	*Xanthium strumarium* L.	9.16
Lambsquarters	*Chenopodium album* L.	7.29
Canada thistle	*Cirsium arvense* (L.) Scop.	2.80
Velvetleaf	*Abutilon theophrasti* Medicus	1.66

4.3. The effect of applications on corn yield

To assess the impact of applications on corn yield and several yield-related parameters; grain yield, plant height, kernel row numbers, cob length, cob diameter and thousand grain weight were compared. Upon observing the experimental area, it was evident that plant heights differed significantly between weed-free control plots and weed control plots. The same situation was clearly observed in cob diameters and lengths (Figure 3. A, C).

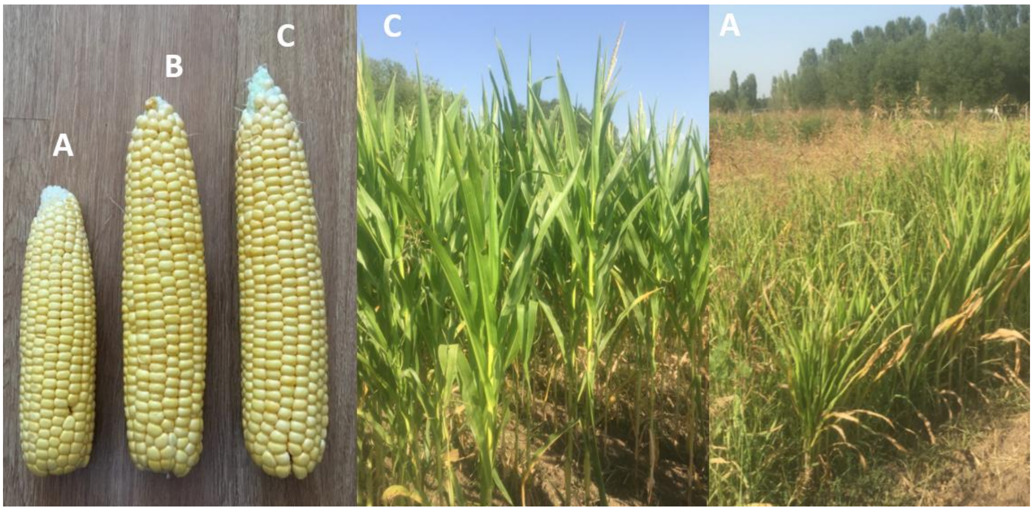


Figure 3. Weedy control (A), 2,4-D EHE + florasulam (B), Weed-free control (C)

When the effects of applications on grain yield were evaluated, a statistically significant difference ($p < 0.05$) occurred between applications. While weed-free control was in a different statistical group, it was determined that there was no significant statistical difference between P and N. The highest grain yield was obtained in WF followed by P and N plots. In addition, it was determined that the effect on grain yield was in a statistical group different from all applications in weed control plots (Figure 4.A). Statistical analysis revealed that the effects of applications on kernel row numbers were different in certain groups, while in others, and there were no significant differences. The highest kernel row were found in WF followed by N and P while IT, DT and 2DF were found in same groups (Figure 4.B). Regarding effects of herbicide on cob length (cm), the highest cob length were obtained at the WF plots followed by P, IT and N plots (Figure 4.C). Alptekin et al. (2023) reported similar findings, where Cob lengths ranged from 14.79 to 20.80 cm and 11.65 to 19.62 cm in the first and second experimental years, respectively. Their findings were consistent with our findings in the weed-free plot. Cob diameter varied between 21.2 and 15.3 cm and the weed-free plot produced the longest cobs (21.2cm), as expected. Is was followed by P, N and IT plots (Figure 4.D). Those values are consistent with the reports of Alptekin et al. (2023) and Şahin and Kadıoğu (2021). There could be a correlation between the efficiency of herbicides used for weed management in corn farms and the length of corn cobs (Zaremohazabieh, & Ghadiri, 2011; Pandey et al., 2001). When the effects of the treatments on maize plant height were evaluated, a statistically significant difference occurred between the treatments. The results indicated that WF outperformed all the other plots, and there were no significant differences between IT and TD, P and N in the same statistical category. 2DF was categorized differently in terms of statistical significance. Furthermore, the effect of the applications on maize plant height in the WY plots was in a different statistical group than in all the other plots (Figure 4.E). Upon evaluating the effects of the applications on the thousand grain weight of corn, a statistically significant difference was observed between the applications. It was seen that WF was better than all other plots, while N and P were in the same statistical group, IT, TD and 2DF were in different statistical classes between themselves. Those findings are consistent with the reports of Eymirli and Uygur (2011) and Alptekin et al., (2023). In addition, the effect on maize thousand-grain weight was in a statistical group different from all applications in WY plots (Figure 4.F). Koç and Karaca (2022) also considering the corn stem diameter, cob length, corn stem length, corn stem dry and fresh weight, dry and fresh cob weight, thousand-grain weight and yield per decare in both years, it was determined that two herbicides (Isoxaflutole 225 g/l + Thiencarbazone-Methyl 90 g/l + Cyrosulfamide 150 g/l and Dimethenamid-P 280 g/l + Terbuthylazine 250 g/l) used increased in yield 2 to 3 times compared to the weedy control plots.

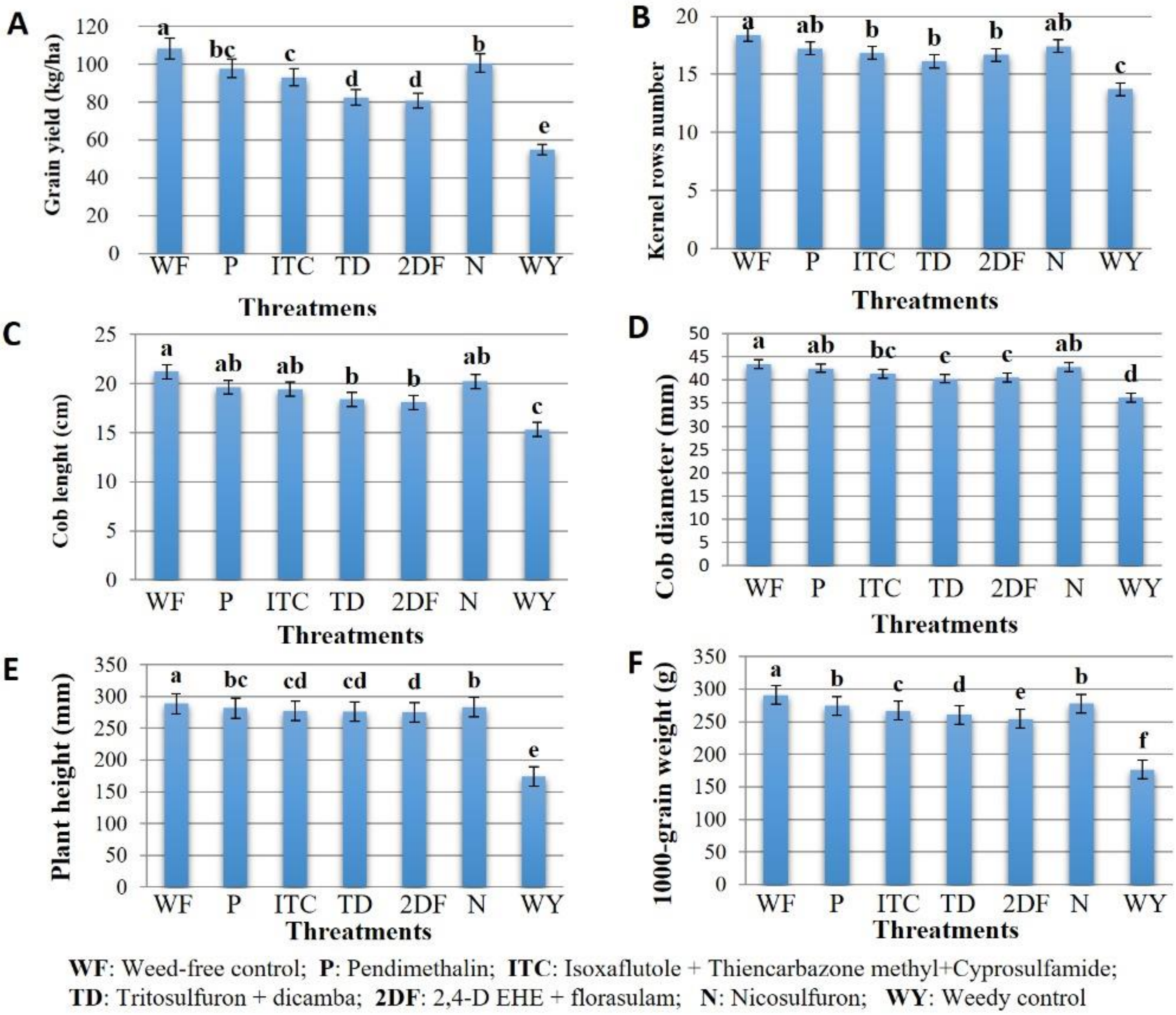
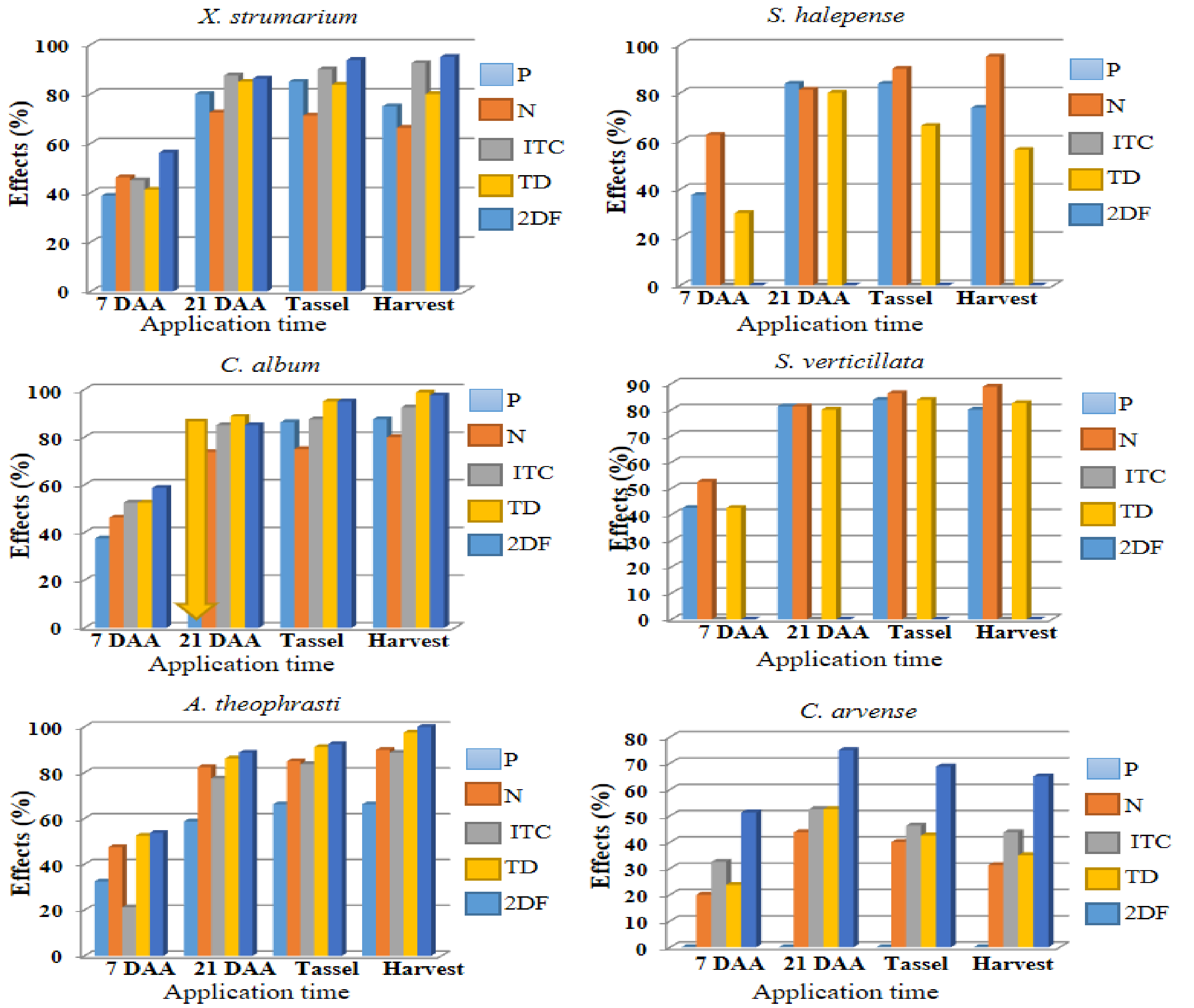


Figure 4. The effects of herbicides on grain yield (kg/ha)(**A**), kernel rows number(**B**), cob length (cm)(**C**), cob diameter (mm)(**D**), plant height (mm)(**E**) and 1000-grain weight (g)(**F**) of maize

4.4. The effect of herbicides applied on weed species

Upon evaluating the percentage effects of applied herbicides on *X. strumarium,* it was found that herbicide P had a 38.75% effect, herbicide N had a 46.25% effect, herbicide TD had a 45.00% effect, herbicide IT had a 41.25% effect, and herbicide 2DF had a 56.25% effect on the 7th day after application. Similarly, on the 21st day after application, herbicide P had an 80.00% effect, herbicide N had a 72.50% effect, herbicide TD had an 87.50% effect, herbicide IT had an 85.00% effect, and herbicide 2DF had an 86.25% effect. During the tassel period, herbicide P had an 85.00% effect, herbicide N had a 71.25% effect, herbicide TD had a 90.00% effect, herbicide IT had an 83.75% effect, and herbicide 2DF had a 93.75% effect. At harvest time, herbicide P had a 75.00% effect, herbicide N had a 66.25% effect, herbicide TD had a 92.50% effect, herbicide IT had an 80.00% effect, and herbicide 2DF had a 95.00% effect on *X. strumarium* (Figure 5). When the percentage effects of applied herbicides on *S. halepense* were assessed, it was found that herbicide P had a 37.50% effect, herbicide N had a 62.50% effect, and herbicide IT had a 30.00% effect on the 7th day after application. Similarly, on the 21st day after application, herbicide P had an 83.75% effect, herbicide N had an 81.25% effect, and herbicide IT had an 80.00% effect. During the tassel period, herbicide P had an 83.75% effect, herbicide N had a 90.00% effect, and herbicide IT had a 66.25% effect. At harvest time, herbicide P had a 73.75% effect, herbicide N had a 95.00% effect, and herbicide IT had a 56.25% effect on *S. halepense*. In contrast, herbicides TD and 2DF were observed to be ineffective against *S. halepense* at all counting times(Figure 5). According to Eymirli's (2011) field trials conducted in Adana, the effect of nicosulfuron on *S. halepense* was reported to be 93.25% and 95.19%. The high efficacy ratio observed for nicosulfuron in controlling *S. halepense* in Eymirli's (2011) study is noteworthy, and a similar high efficacy was observed in the current study. Upon evaluating the percentage effects of applied herbicides on *C. album*, it was found that on the 7th day after application, herbicide P had a 37.50% effect, herbicide N had a 46.25% effect, herbicide TD had a 52.50% effect, herbicide IT had a 52.50% effect, and herbicide 2DF had a 58.75% effect. Similarly, on the 21st day after application, herbicide P had an 86.25% effect, herbicide N had a 73.75% effect, herbicide TD had an 85.00% effect, herbicide IT had an 88.75% effect, and herbicide 2DF had an 85.00% effect during the tassel period. During the harvest period, herbicide P had an 86.25% effect, herbicide N had a 75.00% effect, herbicide TD had an 87.50% effect, herbicide IT had a 95.00% effect, and herbicide 2DF had a 95.00% effect. In addition, it was observed that the herbicides had an average effect of 87.50%, 80.00%, 92.50%, 98.75%, and 97.50%, respectively. Andr et al., (2014) stated in their study that they achieved 96.00% success against isoxaflutole + thiencarbazone methyl *C. album*. When evaluating the effects of applied herbicides on *S. verticillata*, it was found that on the 7th day after application, P, N, and IT herbicides had an equal percentage effect of 42.50%. On the 21st day after application, the percentage effects for P, N, and IT herbicides were 81.25%, 81.25%, and 80.00%, respectively. During the tassel and harvest periods, all three herbicides were highly effective, with percentage effects ranging from 80.00% to 88.75%. TD and 2DF herbicides were found to be ineffective against *S. verticillata* at all counting times. Uysal (2012) conducted field trials to test the efficacy of nicosulfuron against weeds commonly found in corn fields in Tokat and Iğdır. In Tokat, nicosulfuron was found to be 65.00% effective against *X. strumarium*, 67.50% against *C. album*, and 100% against *S. halepense* and *Setaria* spp. In Iğdır, nicosulfuron was reported to be 75.00% effective against *X. strumarium*, 70.00% against *C. album*, 97.5% against *S. halepense*, and 95.00% against *Setaria* spp. Similar results were found in the present study. When evaluating the percentage effects of applied herbicides on *A. theophrasti*, it was found that on the 7th day after application, P, N, TD, IT, and 2DF herbicides had percentage effects of 32.50%, 47.50%, 21.25%, 52.50%, and 53.75%, respectively. On the 21st day after application, the percentage effects for P, N, TD, IT, and 2DF herbicides were 58.75%, 82.50%, 77.50%, 86.25%, and 88.75%, respectively. During the tassel and harvest periods, all five herbicides were effective, with percentage effects ranging from 66.25% to 100%. Specifically, the percentage effects during the harvest period were 66.25% for P, 85.00% for N, 83.75% for TD, 91.25% for IT, and 92.50% for 2DF. The findings of the current study for nicosulfuron were in agreement with the findings of Baghestani et al. (2007), who found that the herbicide nicosulfuron at a rate of 80 g ai/ha was effective in controlling broadleaved and grass weeds in maize fields in Iran when applied after the emergence of the weeds. Overall, the herbicides were most effective against *A. theophrasti* during the harvest period, with 2DF having the highest percentage effect of 100%. When evaluating the percentage effects of applied herbicides on *C. arvense*, it was found that on the 7th day after application, N, TD, IT, and 2DF herbicides had percentage effects of 20.00%, 32.50%, 23.75%, and 41.25%, respectively. On the 21st day after application, the percentage effects for the same herbicides were 43.75%, 52.50%, 52.50%, and 75.00%, respectively. During the tassel and harvest periods, N, TD, IT, and 2DF herbicides were effective, with percentage effects ranging from 40.00% to 75.00%. Specifically, during the harvest period, the percentage effects were 46.25% for N, 42.50% for TD, 68.75% for IT, and 65.00% for 2DF. P herbicide did not show any effect against *C. arvense* at all counting times (Figure 5). According to the field trials conducted by Güngör (2005), nicosulfuron was reported to have an effect of 90.86% against *S. verticillata*, 61.58% against *X. strumarium*, and 97.47% against *S. halepense*. Manea et al. (2010) reported an average efficacy of 93.60% for isoxaflutole + thiencarbazone methyl in controlling *S. halepense*, *C. album*, *X. strumarium*, and *C. arvense* in their experimental area. On the other hand, Torma et al. (2007) found that 2,4 D + florasulam was ineffective on *S. halepense*, had an efficacy of 60.00% on *C. album*, and 95.00% on *A.theophrasti* in two different trial areas. These findings are similar to the results observed in our study.



P: Pendimethalin; **ITC**: Isoxaflutole + Thiencarbazone methyl+Cyprosulfamide; **TD**: Tritosulfuron + dicamba; **2DF**: 2,4-D EHE + florasulam; **N**: Nicosulfuron; **DAA**: Days after the application

Figure 5. The effects of herbicides on *Sorghum halepense*, *Portulaca oleracea*, *Xanthium strumarium*, *Amaranthus retroflexus* and *Convolvulus arvensis*

This study aimed to explore the potential management strategies for weeds in maize fields in the Igdir province of Türkiye. The study involved an assessment of the weed species present in maize fields, as well as an evaluation of the efficacy of specific herbicides in controlling weeds and improving maize yield. A survey was carried out with the aim of identifying the weed species that were present in the maize fields located in the province. The survey findings revealed the presence of 25 weed species, which belonged to 11 different families. The top three largest families identified were Poaceae (8 species), Fabaceae (4 species), and Asteraceae (3 species). Out of the 25 weed species, 13 of them had a frequency of more than 10 percent. The top 5 species identified based on frequency were *S. halepense* (94%), *P. oleracea* (68%), *X. strumarium* (62%), *A. retroflexus* (38%), and *C. arvensis* (28%). On the other hand the experiment area was dominated by *S. halepense* and *X. strumarium* weed species, whereas weeds from the Fabaceae family, which were deemed significant in the surveyed fields, were not observed in this region. The absence of these weeds can be attributed to various factors such as soil composition, cultivated crops, crop rotation, herbicide application, and cultural practices. This information is useful for farmers and researchers to understand the weed community in maize fields, which can help in developing effective weed management strategies. It also provides insight into the relative importance of different weed species and families in terms of their frequency of occurrence in the surveyed fields. The impact of herbicides on the assessment of maize yield and its components, such as cob row number, cob length and diameter, plant height, and thousand grain weight, demonstrated a substantial increase across all treatments in comparison to the weedy control. The percentage increase in yield components indicated a 98% increase in yield, a 31.3% increase in the number of rows of cobs, a 38.5% increase in the length of the cob, a 19.8% increase in the diameter of the cob, a 66.2% increase in the height of the plant, and a 64.8% increase in the thousand grain weight. The increase in the thousand grain weight suggests that the herbicides may have contributed to the overall improvement in maize crop quality. These findings are valuable for developing effective weed management strategies that can help improve maize yield and quality in the region.

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