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RESEARCH PAPER

# Evaluation of row cultivation of wheat (*Triticum aestivum*) and bean (*Vicia faba*) on weed control in Ahvaz climate

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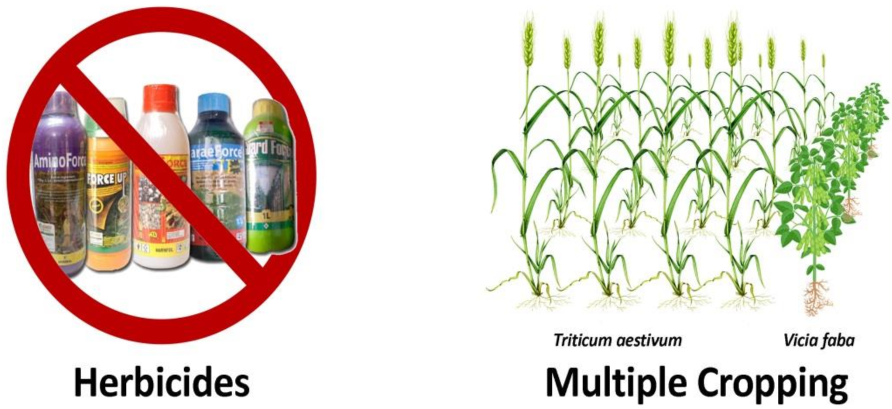
## Highlights

• Weeds are one of the factors limiting the growth and development of wheat planting in the country and the region.

• Multi-cropping can be considered as one of the effective methods in controlling weeds and increasing field efficiency.

• In this study, two plants, wheat and bean, were selected according to their characteristics to create a multi-cropping system in the region.

## Graphical Abstract

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## Abstract

To study the effects of row cropping of wheat and beans on weed control in Ahvaz climate, the experiment was conducted in the research farm of Khuzestan Faculty of Agriculture and Natural Resources as a randomized complete block experiment with four replications. The treatments studied included two types of plants, wheat (Chamran cultivar) and beans (local) as monoculture and in mixed composition in different densities of wheat (400 plants and 200 plants/m$^2$) and beans (40 and 20 plants/m$^2$) were planted. The results showed that the different plant densities of beans and wheat in multiple crops had a significant effect on the number and dry weight of weeds. Comparison of mean values showed that at suitable plant densities (400 wheat plants and 40 bean plants/m$^2$), weed growth in pure crops and intercrops showed little difference. Even at densities of 200 wheat plants, 20 and one bean plant/m$^2$, the effects of multiple crops on weed control were more effective than in monocultures. For example, the minimum number of weeds was 16 in the mixture of 1 row of beans and 4 rows of wheat and 24 in the wheat-only crop at a density of 400 plants/m$^2$. It appears that plant density in this experiment was able to influence the number and dry weight of weeds through competition and more appropriate use of space.



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## 1. Introduction

Considering the needs of the wheat plant and its sensitivity to food, pests, diseases and especially weeds to increase yield and sustainability in the management of agricultural systems, the use of agricultural operations appropriate to the conditions of the region is obvious. Weeds are one of the most important factors limiting the production of crops, especially the strategic crop of wheat in all parts of the world, and the control of this factor at the global level accounts for a large part of the cost of agricultural production. Weed competition in wheat, often in the early stages of growth and elongation of the stem in autumn cultivation leads to reduced yields and prevents the usual growth process in spring planting. High-altitude weeds and tolerant species cause more problems in the wheat plant and reduce the leaf area of wheat as well as its yield. In addition, in autumn wheat cultivation, which is the long period of the establishment before the plant grows rapidly in spring, any weed that grows at the same time as the crop grows rapidly during this period and can severely reduce the plant's ability to overwinter. In such cases, it is necessary to control weeds, especially at the beginning of the growing season. The presence of green weeds in the crop before or at the same time of harvest may delay and reduce the efficiency of harvesting operations, increase the cost of drying, storage, handling and seed seeding. Weeds can also host disease-causing fungi on wheat. Therefore, due to the adverse effects of weeds from the early stages of growth to the stage of maturity, weed control is of particular importance. In the world, various cropping methods (such as rotation, planting time, plowing management between crop rows, seeding and manual and mechanical weeding) and especially herbicides (on a large scale) are still used to control weeds (Mahboub Khomami et al., 2021).

Due to the environmental pollution caused by the high consumption of herbicides, today, crop management and integrated methods such as the use of multiple cropping systems can be helpful. Wheat plant has a special place in the country's agricultural development programs. On the other hand, weeds are one of the factors limiting the growth and development of wheat planting in the country and the region. In this regard, multiple cropping can be considered as one of the effective methods in controlling weeds and increasing field efficiency (Dixit, 2020). To select the accompanying plant in the composition of wheat intercropping, initial studies in the region showed that the agronomic characteristics of the bean plant have advantages. Therefore, in this research project, two wheat and bean plants were selected according to their characteristics to create multiple cropping cultivation systems in the region. It is expected that by determining the best treatment and multiple cropping compositions, the restrictions on planting wheat as a mono (pure) crop will be reduced. In addition, the evaluation of multiple cropping efficiency in terms of land parity ratio, determining the relationship between the yield density of pure and multiple cropping crops and how the two plants can compete (Sarker et al., 2020).

### *1.1. Basics of multiple cropping*

The need to produce more food is one of the problems of human societies. Given that, the possibility of increasing the cultivable area is limited (Reddy et al., 1980). Agricultural development experts focus on strategies that lead to more and more efficient land use and increased production (Calavan and Weil, 1988). One of these solutions is research on various types of multiple cropping systems that allow more production per unit area and time (Mandal et al., 1996). Multiple cropping systems may be one of the first types of organized agriculture. These systems, often used by smallholder farmers in developing countries, form the basis of traditional agricultural systems (Sepahvand et al., 2021; Baker, 1978). Because high-efficiency environmental resources are used in these systems, researchers in developed countries, as well as in developing countries, pay special attention to the application and research of these systems (Willey and Osiru, 1972; Rees, 1986). Ecologists pay attention to these systems due to their structure to the ecosystems of natural systems in terms of species diversity and biological sustainability. Agriculturalists and physiologists consider the optimal use of resources and environmental factors during most of the year as the most important reason to study these systems. Economists concerned with the sustainability of production and household incomes consider the biodiversity of multiple cropping systems to be an important factor in adjusting annual household incomes. Sociologists also help them achieve these goals by continuing their search for an understanding of the disciplines that link people and goals to the capabilities of the environment (Sepahvand et al., 2021).

### *1.2. Combining different plants in multiple cropping*

Different combinations can be used in selecting the type of plants for multiple cropping (Gharineh and Moosavi, 2010). The choice of allocating plants for multiple cropping to plant composition, planting time and planting pattern are different in each region. It also depends on the climate, soil, topography, available water, pests and diseases, weeds and economic conditions of the community. Plant compositions in multiple cropping are grouped according to criteria. Some of these criteria are:

a) In connection with the life cycle: annual plant + annual plant.
b) Related to the type of products: cereals + legumes, legumes + oilseeds.
c) In connection with morphological characteristics: tolerant plants + sensitive plants, strong plants + weak plants.
d) In the field of food: food additive plants + food depleting plants.
e) In connection with the fight and prevention of weeds, pests and diseases: sensitive plants + resistant plants.

### *1.3. Weeds and their control in multiple cropping*

Farmers are constantly suffering from weeds in the production of agricultural products, and for this reason, various plowing systems and herbicides are used to control weeds in annual crop activities. As herbicides cost 20 to 30% in most countries. In Canada, 80% of chemical pesticide sales go to insecticides and herbicides, valued at $ 1.1 million (Blackshaw et al., 2000 a). The presence of weeds is the most important factor limiting the production of many crops, including wheat. It has adverse effects on agricultural systems. Due to the characteristics of the wheat plant and its sensitivity, some of the adverse effects of the presence of weeds in wheat cropping systems are as follows:

a) Reduce the quantity and quality of harvested seeds.
b) Delayed harvest and reduced harvest efficiency.
c) By contaminating the seeds of the harvested crop, they increase the costs of drying, separation, waste, seed transport, and its current odor.
d) In the prevalence of pests, diseases affect the wheat plant and the next crop.
e) Be problematic for your next crop by dropping your seeds.
f) Increase tillage operations.

Successful weed management requires the use of the simplest control methods such as preventing the production of weed seeds, reducing the emergence of weeds and reducing the competition of weeds with the crop, especially at the beginning of the growing season are essential strategies. In addition, by performing various agricultural operations, weed management will be affected and will cause stability in environmental conditions (increase soil health, reduce pest and weed pressure and increase reversibility potential). Expanding the use of herbicides and environmental issues and the emergence of weed resistance to herbicides are some of the reasons for returning from agriculture completely dependent on herbicides to an integrated approach of agricultural methods in weed management, including:

a) Crop rotation (Blackshaw et al., 2000 a).
b) Cover crops, green manures (Harker et al., 2003 b).
c) Multiple cropping (Derksen et al., 2002).
d) Plant species and cultivars, seed rates and planting patterns (Harker et al., 2003 a).
e) It is also plowing and chemical control (Azizi, 2004; Blackshaw et al., 2000 b).

### *1.4. Factors affecting weed control in multiple cropping*

Various environmental factors and management can influence competitive control of weeds in multiple cropping in this regard, such as:

a) Crop density
b) The spatial arrangement of the crop
c) Species and genotype of crop
d) Soil fertility is very important (Liebman et al., 1997)

The most well-known example of the effect of multiple cropping on weeds is the cultivation of cover crops between pure cultivation rows (Fig. 1). Liebman et al., (1997) in nine researches and studies on 23 different combinations of cover crops and crops that he examined, except three combinations of these 23 cases, the rest led to a significant reduction in weeds (Liebman et al., 1997). This phenomenon is especially important in suffocating plants and live mulch. In these systems, species that have good growth and control weeds are cultivated among the rows of the main crop. For example:

a) Beans + Lolium
b) Beans + berseem clover
c) Peas + canola

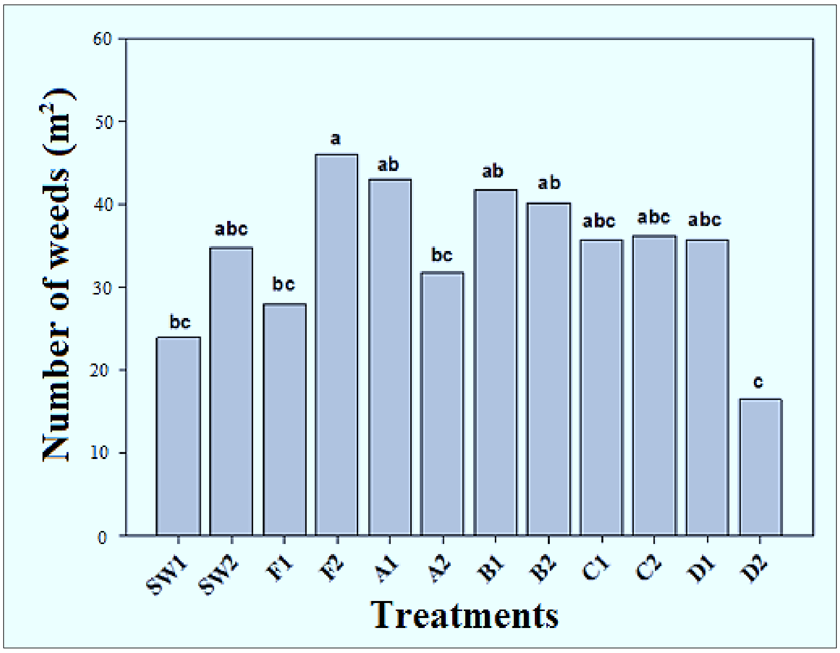


**Figure 1.** Comparison of the average number of weeds in different densities and compositions of multi-cropping and mono-cropping agriculture.

In these compounds, the growth and survival of weed seedlings, especially perennials, are severely affected and reduced. Of course, the intensity of weed control varies not only between different mixed crops but also between similar multiple cropping located in different locations or under different managements (Liebman et al., 1997). The results of studies have shown that multiple cropping of legumes, in addition to providing nitrogen for corn, can improve soil fertility, crop yield and weed control simultaneously. In addition, the use of cover crops and their residues has the potential to reduce pests and weeds to prevent competition, physical stress and allelopathy effects. In an experiment, the use of legumes such as sweet clover in multiple cropping effectively reduced the establishment of weeds and increased wheat production the following year (Harker et al., 2003 b). Today, the use of cover crops such as sweet clover, red clover and autumn oats to manage weed control is widespread in organic farming in Canada that using them in common green systems can be beneficial. Three-year studies of two regions in Canada showed that multiple cropping is one of the high potential methods in weed management. As the dry weight of weeds in canola barley, multiple cropping was lower than their pure cultivation.

### 1.5. Common weed species in wheat fields

The most common weed species in autumn wheat fields from leading cereals that compete with this crop, as weeds (in Iran) are present in Table 1.

**Table 1.** Common weed species in wheat fields in Iran.

| Row | Latin | Family |
|---|---|---|
| 1 | *Loliom Spp* | Poaceae |
| 2 | *Hordeum Spp* | Poaceae |
| 3 | *Phalaris Spp* | Poaceae |
| 4 | *Bromus Spp* | Poaceae |
| 5 | *Setaria Spp* | Poaceae |
| 6 | *Secale Spp* | Poaceae |
| 7 | *Avena Spp* | Poaceae |
| 8 | *Convolvuius Spp* | Convolvulaceae |
| 9 | *Rapistrum Spp* | Brassicaceae |
| 10 | *Acroptilon* | Asteraceae |
| 11 | *Sinapis Spp* | Brassicaceae |
| 12 | *Fumari Spp* | Papaveraceae |
| 13 | *Anthemis Spp* | Asteraceae |
| 14 | *Chonopodium Spp* | Amaranthaceae |
| 15 | *Capsella Spp* | Brassicaceae |
| 16 | *Rumex Spp* | Polygonaceae |
| 17 | *Lactuca Spp* | Brassicaceae |
| 18 | *Alhagi Spp* | Fabaceae |
| 19 | *Glycyrrhaza* | Fabaceae |
| 20 | *Polygonum Spp* | Polygonaceae |
| 21 | *Malva Spp* | Malvaceae |

It is noteworthy that in 2014-15, weed control operations were carried out in wheat fields of Khuzestan province at an area equivalent to 1160,000 hectares, including 620,000 hectares of broadleaf weeds and 540,000 hectares of narrow-leaved weeds. There were 98,000,000 and 180,000 hectares on irrigated and rainfed fields, respectively. Weed management will be developed in the future by increasing the diversity of planting systems with highly competitive plant cultivars, using high-quality seed rates, rotation and multiple cropping, diversification of agricultural systems to increase soil health, reduce pest pressure and weeds stabilize and increase the potential for reversibility. This diversity includes not only the use of oilseeds and forage crops in crop rotation but also the use of multiple cropping, green manures and cover crops. Adaptation of diverse agricultural systems to economic and environmental health issues will lead to the future of agriculture.

### 1.6. Selection of legume plants in multiple cropping

In order to achieve the benefits of multiple cropping, the selection of suitable plants and compatibility with the conditions of the region and the design of the appropriate multiple cropping composition is of particular importance. Therefore, according to the desired agricultural goals, it is possible to design multiple cropping. In several experiments, the presence of a legume plant in multiple cropping has been investigated. It gives a useful role to the legume plant and is effective in achieving the benefits of multiple cropping. For this reason, consider a legume plant in many compounds mixed with other plants such as cereals (corn, sorghum, barley, wheat), tuberous plants (such as potatoes, cassava), oil (such as rapeseed, sunflower, sesame) and Forage plants, coffee and flax are recommended. Combined plants in multiple cropping of the leguminous family are very diverse. Some of these plants are presented in Table 2.

**Table 2.** Legume plants used in multiple cropping in the world.

| Row | Latin name |
|---|---|
| 1 | *Phaseolus vulgaris* |
| 2 | *Vignaung uiculata* |
| 3 | *Cicer arietinum* |
| 4 | *Vicia faba* |
| 5 | *Vigna radiata* |
| 6 | *Arachis hypogaea* |
| 7 | *Ceci neri* |
| 8 | *Glycine max* |
| 9 | *Sesbania* |

## 2. Materials and methods

This experiment is based on the principles of multiple cropping and considering the influence of plant species and the species composition ratio of two species of wheat and beans in different densities to increase production and weed control in the research farm of Khuzestan University of Agriculture and Natural Resources. The city of Malasani is considered as a semi-arid region in terms of climate. During the experimental period, the amount of rainfall was 95.02 mm, the minimum temperature was 4.9 in January and the maximum temperature during plant growth was 39.03 °C in May. The experiment was performed based on a randomized complete block design with 4 replications and 12 treatments. The treatments included two densities of pure wheat in density (200 and 400 plants/$m^2$) and beans in density (20 and 40 plant/$m^2$) and eight treatment combinations for two species (Table 3).

**Table 3.** Guidelines for combinations of different densities of wheat and beans in multiple cropping.

| Profile | Compounds of different densities of wheat and beans |
|---|---|
| $SW_1$ | Pure wheat density of 400 plants /$m^2$ |
| $SW_2$ | Pure wheat density of 200 plants /$m^2$ |
| $F_1$ | Pure Beans density of 40 plants /$m^2$ |
| $F_2$ | Pure Besan density of 20 plants /$m^2$ |
| $A_1$ | One row of beans (40 plants /$m^2$) + One row of wheat (400 plants/$m^2$) |
| $A_2$ | One row of beans (40 plants/$m^2$) + Two rows of wheat (400 plants/$m^2$) |
| $B_1$ | One row of beans (40 plants /$m^2$) + Three rows of wheat (400 plants /$m^2$) |
| $B_2$ | One row of beans (40 plants /$m^2$) + Four rows of wheat (400 plants /$m^2$) |
| $C_1$ | One row of beans (20 plants /$m^2$) + One row of wheat (200 plants /$m^2$) |
| $C_2$ | One row of beans (20 plants /$m^2$) + Two rows of wheat (200 plants /$m^2$) |
| $D_1$ | One row of beans (20 plants /$m^2$) + Three rows of wheat (200 plants /$m^2$) |
| $D_2$ | One row of beans (20 plants /$m^2$) + Four rows of wheat (200 plants /$m^2$) |

Multiple cropping was planted in the mixed culture system based on incremental series. Before planting, 50 and 100 kg/ha of ammonium phosphate and nitrogen fertilizers were added to the soil as the initial fertilizer, respectively. Ammonium phosphate was sprayed on the ground and mixed with soil. Nitrogen fertilizer along with irrigation water was used early in the growing season. Local bean seeds and wheat seeds of Chamran cultivar were prepared from Safiabad agricultural research center (Dezful). Bean and wheat seeds were sown simultaneously in October at a depth of 4 cm in the soil and with the desired densities. Wheat seeds were sown on stacks and beans in hot water based on the required densities in multiple cropping and pure form and the sowing operations were done manually and in heaps and were thinned to create the desired density. The first irrigation after planting was done using a siphon and subsequent irrigations were done as needed. The experiment consisted of 48 plots and the dimensions of each plot were equal to (3 × 1.8) 5.4 $m^2$. The distance between planting lines for both plants was 15 cm. 12 planting lines in each plot were spaced 30 cm apart between the experimental units of two planting rows. Wheat and bean seeds were disinfected with Mancozeb fungicide brand (Dithan M 45 WP 80%) before planting and planting and harvested according to the plan.

Given that the purpose of the plan was to determine the status of weeds; therefore, no action was taken against weeds mechanically or chemically and the control was performed under the influence of experimental treatments. Seeds were harvested at the ripening stage with a moisture content of 14% for wheat and 15% for beans, respectively. In each test unit, two rows on either side or one meter from the beginning and end of the rows were removed as margins. The bushes were cut from the floor and wrapped with hemp string. Sampling and measurement were performed to determine the biological and grain yield of the two middle rows. Beans were harvested in early May and wheat in mid-May.

After harvesting, the samples were transferred to the laboratory and dried in laboratory conditions and the following parameters were measured. Weed sampling was performed to evaluate the effect of multiple cropping on the condition of weeds with an area of one square meter and based on the random placement of the frame in the middle lines of the plots in the experimental replications. All weeds at the sampling level and in the first week of March in the flowering stage were counted, collected and named and then their dry weight was measured by placing the samples in an oven at 75 °C for 48 hours. In addition, in order to determine the species composition and weed diversity in the experimental units in different combinations of multiple cropping and pure culture, the samples were separated and identified in the laboratory.

## 3. Results and Discussion

### *3.1. Density (number) and dry weight of weeds*

The results of the analysis of variance of the studied treatments in multiple cropping of wheat and beans are presented in Table 4. The effect of different bean and wheat plant density ratios on the number and dry weight of weeds was significant at 5 and 1% levels, respectively. Comparison of the mean of evaluated traits in pure and multiple cropping of wheat and beans shows that in suitable plant crop densities (400 plant/$m^2$) and beans (40 plants/$m^2$) weed growth in pure and mixed crops is showing. At a density of 200 wheat plants and 20 bean plants, the effects of multiple cropping were effective on weed control. The lowest number of weeds in the multiple cropping of one row of beans and four rows of wheat (16 and pure wheat cultivation with a density of 400 plants/$m^2$) was obtained. The highest number of weeds in pure bean cultivation is at a density of 20 plants/$m^2$ and pure wheat cultivation at a density of 200 plants/$m^2$ (Table 4). Sampling was done to determine and measure the number and dry weight of weeds in the early growth stage of wheat spike and late flowering or the beginning of bean pods. It seems that plant density through competition and more appropriate space occupation in this experiment could affect the number and dry weight of weeds.

**Table 4.** Average number and dry weight of weeds in different densities in multiple cropping and pure cultivation

| Plant composition | Density (plants/m2) | Dry weight (grams/$m^2$) |
|---|---|---|
| Pure wheat cultivation (400 plants) | 24 | 27 |
| Pure wheat cultivation (200 plants) | 35 | 47 |
| Pure cultivation of beans (40 plants) | 49 | 62 |
| Pure cultivation of beans (20 plants) | 52 | 106 |
| Cultivation of wheat-bean multiple cropping | 35 | 60 |

In addition, in Figs. 1 and 2, the status of number and dry weight of weeds in different combinations of wheat and bean multiple cropping have been compared. The combination of bean and wheat multiple cropping with one row and four rows had the lowest number and pure wheat cultivation with a density of 400 plants had the lowest dry weight of weeds. Since the selection and appropriate pattern for multiple cropping according to physiological and morphological characteristics and other environmental conditions can play a special role in the function of multiple cropping. Among the various multiple cropping compounds in this experiment, the combination of one row of beans and four rows of wheat shows the lowest number of weeds compared to other mixed compounds (Table 5). This combination seems to have been close to pure cultivation conditions with a density of 400 plants/m$^2$.

**Table 5.** Comparison of different combinations of wheat and bean multiple cropping on weed number.

| Multiple cropping composition | Density/m$^2$ |
|---|---|
| One row of beans + One row of wheat | 40 |
| One row of beans + Two rows of wheat | 34 |
| One row of beans + Three rows of wheat | 39 |
| One row of beans + Four rows of wheat | 28 |

The study of the effects of density and multiple cropping shows that the density of 400 wheat plants and 40 bean plants in pure cultivation had a greater effect on the number and dry weight of weeds compared to multiple cropping. This may be related to the type of multiple cropping compositions. One row of beans as a second plant in different multiple cropping was not enough and therefore did not have the expected effect. On the other hand, the selection of density of 400 wheat plants and 40 bean plants per square meter has provided favorable conditions in pure cultivation for weed control in the region (Gharineh and Moosavi, 2010). It is noteworthy that although some of the multiple cropping compounds may be close to pure culture in terms of density, they have a weaker growth and are often located under multiple cropping vegetation.

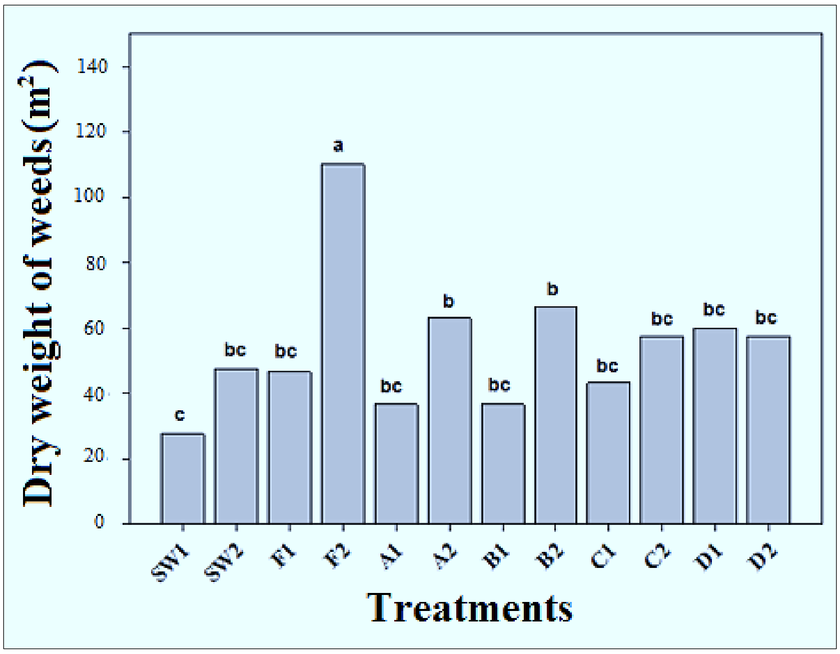


**Figure 2.** Comparison of the average dry weight of weeds in different densities and compositions of multi and mono-cropping.

### *3.2. Composition and diversity of weed species*

Species composition of weed communities among different crops in pure and multiple cropping cultivation is variable. Therefore, comparing the density and flora of weeds of multiple cropping agriculture with the flora of weeds will be useful in the pure cultivation of each component of the multiple cropping. In this experiment, considering the effect of planting methods on the density and species composition of weeds and how these changes in different treatments of multi and mono-cropping of wheat and beans were investigated. In general, the weeds observed in the experimental units under field conditions are presented in Table 6.

**Table 6.** Detected weeds in abundance in experimental units (broadleaf and narrow leaf) in different densities and combinations of multi and mono cropping of wheat and beans, respectively**.**

| Narrow-leaf | Broadleaf |
|---|---|
| Lolium temulentum | Convolvulus |
| Polygonum | Malva |
| Sonchus arvensis | Sinapis arvensis |
| Avena fatua | Cichorium intybus |
| - | Procombentes |
| - | Medicago sativa (annual) |
| - | Rumex acetosa |
| - | Trifolium repens (annual) |

Liebman et al., (1997) also observed that in the pure cultivation of barley and chickpeas as well as their multiple cropping by increasing the seed weight of the crop, the total dry weight of all weed species and the relative importance of the dominant weed species such as *Amaranthus* and *Brassica oleracea* Decreased (Liebman et al., 1997). In addition, the highest uniformity in the relative abundance of different weed species was observed in pure barley and the lowest uniformity was observed in pure chickpea cultivation, and multiple cropping was intermediate in this regard. The results show that weed species diversity in pure wheat and bean cultivation was higher than multiple cropping compounds. Species such as *Malva*, *Polygonum*, *Sinapis arvensis*, *Convolvulus*, *Procombentes*, *Lolium temulentum*, *Rumex acetosa* and *Lactuca serriola* were observed in pure culture. In multiple cropping compounds it seems that due to the existence of interactions and the presence of the bean plant, the species diversity of weeds decreases and most plants such as *Malva*, *Sinapis arvensis* and *Procombentes* are present (Table 7). It is noteworthy that weeds in different multiple cropping compositions were weaker in terms of growth status than pure cultivation and were often in the lower floors of the field and dominated by crops.

**Table 7.** Variety and composition of weed species based on the abundance in mono and multi-cropping systems of wheat-bean.

| Multiple cropping composition | Weed species |
|---|---|
| Pure cultivation of wheat | *Lolium temulentum, Avena fatua, Malva, Sinapis arvensis, Polygonum, Convolvulus, Rumex acetosa and Lactuca serriola* |
| Cultivation of pure beans | *Malva, Sinapis arvensis, Procombentes, Convolvulus* |
| Different combinations of wheat-bean multiple cropping farming | *Malva, Procombentes, Sinapis arvensis* |

Plant differences in terms of change and innovation in agricultural operations and competitive characteristics of crops and weeds cause changes in weed species and their dominance among crops. For this reason, changes in crop density and spatial arrangement have prevented an increase in the population of a particular weed species in this experiment.

## 4. Conclusion

Conventional agricultural systems, especially mono-cropping systems, require a lot of cost and energy from fossil fuels (directly and indirectly). Ecologically and ecologically, mono cropping has caused serious problems on a large scale. The use of chemical fertilizers and pesticides has endangered the existence of the planet by creating various pollutants caused by industrial activities. Due to the environmental problems caused by the usual approaches to increase production, today the tendency to sustainable systems in agriculture has become important. The most important principle in the sustainability of agricultural systems is diversity. If agricultural activities are carried out according to ecological principles, the issue of sustainability will be achieved while preventing the destruction of ecosystems. Multi cropping means the cultivation of more than one crop on a plot of land in one crop year and is a market example of sustainable systems in agriculture. This cropping system pursues goals such as creating ecological balance, maximum utilization of natural resources, increasing the quantity and quality of yield and reducing damage caused by pests, diseases and weeds, soil health, reducing machine pressure and economic risk. In this method, a third factor called time is used in the production of crops. In addition to production, this method, while improving the proper management of resources, also considers maintaining the quality of resources and the environment. The use of multi-cropping agriculture in the region of Khuzestan province with the use of common crops can in this regard affect the stability of the ecosystem of agricultural systems in biological, economic and environmental dimensions. Due to the development of the area under wheat cultivation in the region and the existence of agricultural problems in order to increase yields, control weeds and increase the efficiency of space and time in the field, in this experiment, a planting pattern of wheat and beans in different densities was designed. In general, the results show that the multi cropping used in this experiment had an effect on weed status. The number and dry weight of weeds in pure cultivation with a density of 400 plants compared to multi and mono-cropping cultivation at low densities (200 and 20 plants per square meter of wheat and beans) show a decrease. Therefore, in addition to different combinations of multi-cropping, density can be expressed as one of the factors affecting the weed situation in wheat fields in Khuzestan province.

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