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# Effect of plant residues broad bean in quantitative characters of some wheat varieties *Triticum aestivum* L.

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**ABSTRACT**

An experiment was carried out in the fields of the Rashidieh region for the season (2022-2023) and planted seeds of five introduced genotypes of bread wheat to determine the effect of broad bean crop (*Vicia faba* L.) on five wheat varieties. *Triticum aestivum* L. experimental field was divided into three replicates according to the (R.C.B.D.)Randomized Completely Block Design. Result show an increase in Plant height, Flag leaf area, and Number of spikes/plants in all varieties that were planted in soil containing plant residues Legume(PLR), the highest rate of increase in plant height was (20.75%) in variety (3) planted in PLR, while the PLR caused the highest increase in leaf area and Number of spikes/plant, which was (25.15 and 100%), respectively in variety (2). PLR also caused the highest increase in(Spike length, Number of grains/spike, and Biological yield) in all varieties that were (51.68, 41.43 and more than 100 %) respectively in variety (2), while result show a decrease in the amount of protein and gluten, as well as ash, for all varieties growing in the legume soil, The highest rate of decrease in Proteins% and Gluten% was in variety (2), which is (19.85. and 10.12) respectively while in Ash The highest rate of decrease was(15.38%(in variety (1) by effect of legume soil.

## 1. Introduction

Wheat is one of the most important cereal in the world and more planted and produced, that have an important role in investigating food safety .so as wheat conceder main source of energy that humans need for their food, that have characters make it important in food of human, such as good balance between proteins and carbohydrate .wheat formed 20 % from Calories and protein in food. Wheat formed the first place in the world in a planted area that reached 214 million hectares and it produced 34.254 T\h (FAO,2020). Wheat crop is at the forefront of grains, which humans need for about 75% of their food. It is also considered one of the globally important strategic crops. Iraq is considered one of the first places for the emergence of wheat, but it suffers from low productivity and the quality of the grains produced. (Al-Sebahi et.al.,2015) . Modern agriculture is commercial and goal-oriented and therefore governed by market laws and not sustainable environmental principles. To maintain the sustainability of agricultural ecosystems, it is necessary to identify the factors that hinder them and adopt appropriate strategies. One strategies used in agriculture system to enhance crop yield is overlapping agriculture and agriculture cycle(Singh, et.al.2008). Including legumes as part of the agricultural cycle in the agricultural system has a very important role, as the bean crop is one of the strategic crops in Iraq that is grown in large areas throughout Iraq. Its nutritional importance comes from its containment of protein, carbohydrates, oils, and mineral salts. Therefore, it is used to improve soil fertility as a green fertilizer. (Hussain, et.al. 2013).

Fertilization is of great importance in improving and increasing agricultural production by approximately 50%, as it compensates the soil for the lost nutrients necessary for growth, as it has varying effects on the type of soil, the crop, growth factors, the type of fertilizer, and the method of adding it (Najm, 2010). It is also among the effective means of increasing Production is the optimal use of nutrients, including fertilizers that contain nitrogen, phosphorus, and potassium, which are among the major basic elements that plants need to grow and perform their vital functions (Abbas, 2012).

Due to the negative effects of chemical fertilizers, modern agriculture has turned to find alternatives, and one of these alternatives is the use of plant residues, including plant residues of beans, as Navarro-Sanchezo et al (2019) noted an increase in the production of both watermelon and cauliflower grown in soil that was previously planted with cowpeas and beans. Hussein (2020) showed that legume soils caused a reduction in the percentage of germination, while they caused an increase in the height and dry weight of the shoots of cucumber varieties.

Many farmers in the world in general, and Iraq in particular, use succession in crop cultivation because of its many benefits, including saving the land and stimulating plant growth. Given the succession of the legume and wheat crops in Nineveh Governorate, this study was conducted to determine the effect of broad bean crop (*Vicia faba* L.) on five wheat varieties. *Triticum aestivum* L.

**2. *Methodology***

The experiment was carried out in the fields of the Rashidieh region for the season (2022-2023) and planted seeds of five introduced genotypes of wheat obtained from (ICARDA)). Table (1) shows the ancestry of the genetic. The genetics used in the study were given numbers from (1-5). Soil service operations were carried out, such as plowing, smoothing, and leveling, before planting according to scientific recommendations.

The experimental field was divided into three replicates according to the (R.C.B.D.)Randomized Completely Block Design (Al-Zubaidy and Al-Falahy, 2016). The genotypes were distributed randomly in each replicate, with two lines for each genotype. The length of the line was 2 M, and the distance between the lines was 0.30 M. If the experimental land was divided into two parts, the first part contained in soil containing plant residues Legume(PLR), while the second part soil without any plant residues (control treatment) within the same field.

Urea fertilizer was added at a raté of 20 kg (nitrogen) per dunum (Al-Kubaisi and Saleh 2000), which is equivalent to 43.47 kg urea, in two batches, the first a month after planting, and the second before the budding stage. The experimental plants were harvested in June.

Table (1) Names and ancestry of genetic used in the study.

| Genetic NO. | Name | Ancestry and Source |
|---|---|---|
| 1 | ASEEL- 1 | ICARDA |
| 2 | AZD-2 | ICARDA |
| 3 | BAASHAA -14 | ICARDA |
| 4 | DAJAJ-5 | ICARDA |
| 5 | DEBEIRA//SHUHA-8/DUCULA | ICARDA |

**2.1 *Soli analysis***

Some chemical and physical experimental soil traits taken from farms in the city of Mosul were determined as shown in Table (2). After drying and crushing it, analysis was conducted in laboratories of the Soil Sciences Department / Colleege of /Agriiculture and Forestry.

Table (2) Some physical and chemical soil traits

| **Analysis** | **Result** |
|---|---|
| PH | 6.9 |
| ES | 1.50ds/m |
| N | 0.1886% |
| P | 460ppm |
| Organic Mattter | 3.126% |
| **Textura : Silty clay** | |
| Clay | 37.2% |
| Sand | 20.3% |
| Silt | 42.5% |

**2.2 Studied traits:**

Five plants were tested randomly, excluding the terminal plants from each line, and from the traits:

1. Number of days at 50% flowering
2. Plant height(cm)
3. Number of spikes/plant
4. Flag leaf area (cm2 )The area of the flag leaf was estimated according to the equation

   = ( Length of x width x 0.95……. Thomas (1975).

5. Spike length (cm).
6. Number of grains/spike.
7. Grain yield (g/plant) .
8. 1000 grains weight (g).
9. Biological yield (g/plant) .
10. Harvest index % = (grain yield/biological yield) x100 (Sharma and Smith 1986).

11. percentage of protein, gluten, and ash (%) was also taken in the Laboratory Department / Nineveh Agriculture Directorate using Informatics8600.

**2.3 statistical analysis**

After collecting and tabulating the data for the various characteristics, it was statistically analyzed according to the Randomized Completely Block Design, SAS Statistical Analysis System, were used to conduct statistical and genetic analyses**.**

**3. Results and Discussion**

Results Table (3) show decreases in No.flowering days in all varieties, flowering days by effect of PLR were lowest in the 1 and 2 varieties (7.46 and 6.76%) respectively. this result is considered a positive trait that may be caused in short the life cycle of a plant, that may be due to variations in the genotype for these varieties to respond to temperature and light

(Sebahi et.al ,2015) . Results show an increase in Plant height, Flag leaf area, and Number of spikes/plants in all varieties that were planted in PLR which may be due to the legumes' increase for soil fertility and N fixation in soil (Hussain, 2020). The highest rate of increase in plant height was (20.75%) in variety (3) planted in PLR, while the PLR caused the highest increase in leaf area and Number of spikes/plant, which was (25.15 and 100%), respectively in variety (2) . This variation between varieties may be due to genetic variation between varieties(Taher and Hussain, 2021).

Table (3) Effect of PLR in Phenotypic Traits

| Varieties | Tretment | Number of days at 50% flowering | Plant height (cm) | Flag leaf area ($cm^2$) | Number of spikes/plant |
|---|---|---|---|---|---|
| 1 | Control | 134.000b | 81.400h | 37.880h | 8.200de |
| | PLR | 124.000e | 92.960d | 49.920d | 16.460c |
| 2 | Control | 135.660ab | 82.100h | 48.110d | 8.100de |
| | | 130.660c | 90.560e | 60.210a | 19.060a |
| 3 | Control | 134.660b | 84.330f | 41.260f | 5.600f |
| | PLR | 129.000c | 101.830a | 53.370c | 16.830c |
| 4 | Control | 136.000a | 82.100h | 40.550f | 7.500e |
| | PLR | 126.660d | 97.860b | 56.740b | 17.600c |
| 5 | Control | 133.000b | 81.960h | 41.230f | 9 .800d |
| | PLR | 124.330e | 94.930c | 47.050e | 18.030b |

Table (4) Shows an increase in all traits for all varieties tested by the effect of PLR This may be due to the effect of Secondary compounds in the soil and their effect on nutrients and microorganisms in the soil (Scavoa et.al., 2018 ) .Results show PLR caused the highest increase in(Spike length, Number of grains/spike, and Biological yield) in all varieties that were (51.68, 41.43 and more than 100 %) respectively in variety (2) reason can be because this variety is considered one of the most sensitive varieties to secondary compounds released from the legume plant and accumulated in the soil, including (Benzoic, P-hydroxybenzoic, Vanillic, Adipic, Lactic, Succinic acid, Mallic acid, Glycolic, P-hydroxyphenyl lactic. (Asaduzzaman and Asao, 2012) .

Table (4) Effect of PLR in Yield Traits and components

| Varieties | Tretment | Spike length (cm) | Number of grains/spike | Grain yield (g/plant) | 1000 grains weight (g) | Biological yield (g/plant) |
|---|---|---|---|---|---|---|
| 1 | Control | 9.060c | 57.260d | 13.230d | 35.860f | 34.140d |
| | PLR | 10.780b | 68.100c | 39.640c | 37.810e | 97.930c |
| 2 | Control | 8.630d | 59.130d | 12.810e | 39.340d | 34.700d |
| | PLR | 13.090a | 83.630a | 48.190a | 42.110b | 122.680a |
| 3 | Control | 9.300c | 53.600e | 10.040f | 43.870ab | 27.790f |
| | PLR | 8.800d | 76.830b | 49.620a | 44.390a | 120.560a |
| 4 | Control | 9.360c | 48.860f | 12.980e | 39.200 | 31.820e |
| | PLR | 12.240a | 69.960c | 48.270a | 42.790b | 120.080a |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | Control | 8.560d | 52.760e | 13.300d | 38.860d | 34.340d |
| | PLR | 10.960b | 65.800c | 41.480b | 41.330c | 105.950b |

The results of Table (5) show a decrease in the amount of protein and gluten, as well as ash, for all varieties growing in the legume soil. The reason for the decrease is due to the effect of compounds accumulated in the soil, such as phenols, alkaloids, saponins, and others. The highest rate of decrease in Proteins% and Gluten% was in variety (2), which is (19.85. and 10.12) respectively while in Ash The highest rate of decrease was(15.38%(in variety (1) by effect of ,this variation in effect is due to the genetic variation of the varieties, as it was found that there is a difference in the strength of the effect of secondary compounds depending on the varieties Hussein et al. (2018).

**Table (5) Effect of PLR in chemical Traits**

| Varieties | Treatment | Proteins % | Gluten% | Ash% |
|---|---|---|---|---|
| 1 | Control | 12.200c | 31b | 0.52a |
| | PLR | 10.600f | 28d | 0.44b |
| 2 | Control | 14.100a | 32.6a | 0.37f |
| | PLR | 11.300 e | 29.3c | 0.36f |
| 3 | Control | 12.800c | 32a | 0.45b |
| | PLR | 11.300e | 28.5 | 0.41d |
| 4 | Control | 13.200b | 32.6 a | 0.43c |
| | PLR | 12.400c | 28.7 | 0.37f |
| 5 | Control | 12.700c | 32a | 0.39e |
| | PLR | 11.400d | 29c | 0.35h |

Results Fig(1) show PLR caused the highest increase in(harvest index) in all varieties that were that due to increase in Biological yield and grain yield by effect of secondary compound that found in PLR

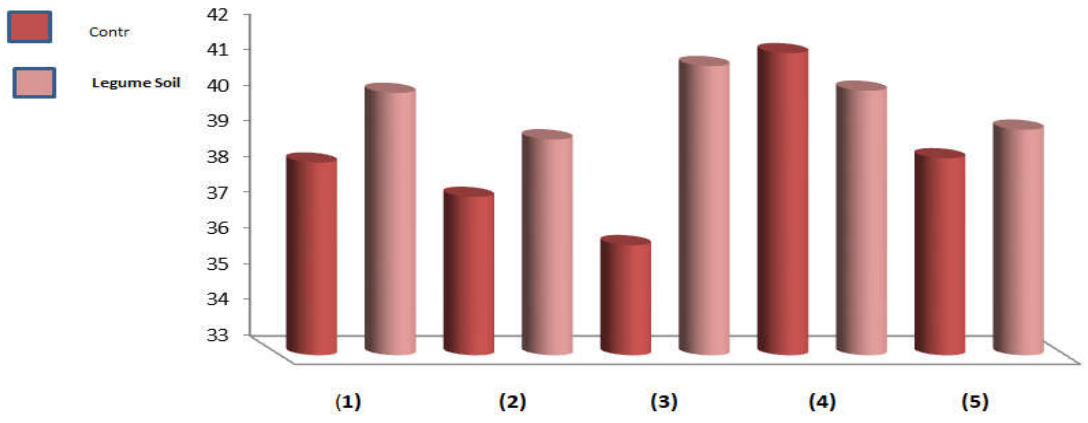


**Figure (1) Effect of PLR in harvest index**

**5. Conclusion ;**

Including legumes as part of the agricultural cycle in the agricultural system has a very important role, as the broad bean crop is one of the strategic crops in Iraq, Its nutritional importance comes from its containment of protein, carbohydrates, oils, and mineral salts. Results show an increase in all traits for all test varieties except a decrease in the amount of protein and gluten, as well as ash, for all varieties growing in the PLR**.**

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