Kurdistan Region- Iraq
Ministry of Higher Education and Scientific Research
College of Agriculture Engineering Science
Horticulture Department
Fourth Stage

Interspecific and intraspecific competition effect on Faba bean (*Vicia faba*) growth and development in pots

Prepared by: Sarwan Sirwan Kareem

Supervised by: Dr. Vain Ali Dler

November 2023

1. Introduction

Broad bean or Faba bean (*Vicia faba*) is one of the oldest domesticated pulses, belongs to Fabaceae family, is nowadays cultivated in almost all regions of the world (Link *et al.*, 2009). Faba bean attracts a growing attention due to nutritional, agronomic and economic advantages. This legume distinguishes itself by a high protein content (26.5%–29.2%), it is also a rich source of other beneficial nutrients including dietary fibers, minerals and phenolic compounds (Abdel-Aal *et al*., 2018).

Competition between neighbors for sunlight, water, and nutrients influence patterns of growth and reproduction, in other words nearby competitors of the same or other species reduce the number of resources available to an individual, which may then suffer reductions in growth, reproduction, germination, and survival. In addition, competition may affect how plants allocate resources to above-ground or belowground growth and reproductive structures (such as flowers) (Schulze, 2002). Individuals compete only with members of their same species called this intraspecific competition, while individuals of one species compete against individuals of another species, called interspecific competition (Mangla *et al.,* 2011). Competition for light results from shading by the leaves and stems of neighboring plants and competition for water and nutrients occurs belowground (Craine and Dybzinski, 2013).

Weeds are defined as “any plant grows where it is not wanted”. The annual weed, Wild barley (*Hordeum spontaneum*) belongs to poaceae family, and recognized as one of the most common and competitive weeds in winter cereals. Competition with weeds is the most important of all biological factors that reduce agricultural crop yield. This occurs primarily because weeds use resources that would otherwise be available to the crop (Zimdahl, 2004). Weeds reduce crop yield and profits by

competing with the crop for soil moisture and nutrients, light, CO2 and space (Klingman & Ashton, 1982).

The aim of this study to show the effect of competition types on plant growth and development of Faba bean (*Vicia faba*) by show the significant differences in plant growth between interspecific and intraspecific competition.

1. Materials and Methods

The experiment conducted at private field / 5 Hasarok to study the interspecific and intraspecific competition effect on Faba bean (*Vicia faba*) in pots. The randomized completely block design (RCBD) with three replicates was used for this experiment, totally number of pots are 21 with diameter of 15 cm and height 30 cm, added of each pot loam and peatmoss (Table 1) at the rate (2:1), two species faba bean (Fito species) and wild barley seed at depth of 5cm and 3cm respectively were sown in the pots on November 1st, 2023. Different competition modes were used in the experiment, the First pot (no competition) planted only broad bean. In second pot (interspecific shoot competition) planted broad bean and wiled barley, in the third pot (intraspecific competition) broad bean and broad bean. In forth pot (interspecific root competition) planted broad bean and wild barley and fifth pot (intraspecific root competition) broad bean and broad bean. In sixth pot and final pot planted for (inter and intraspecific Full competition) broad bean and wild barley and broad bean and broad bean respectively (Fig 1 and 2). Through the experimental period plants were watered as necessary with manual irrigation.

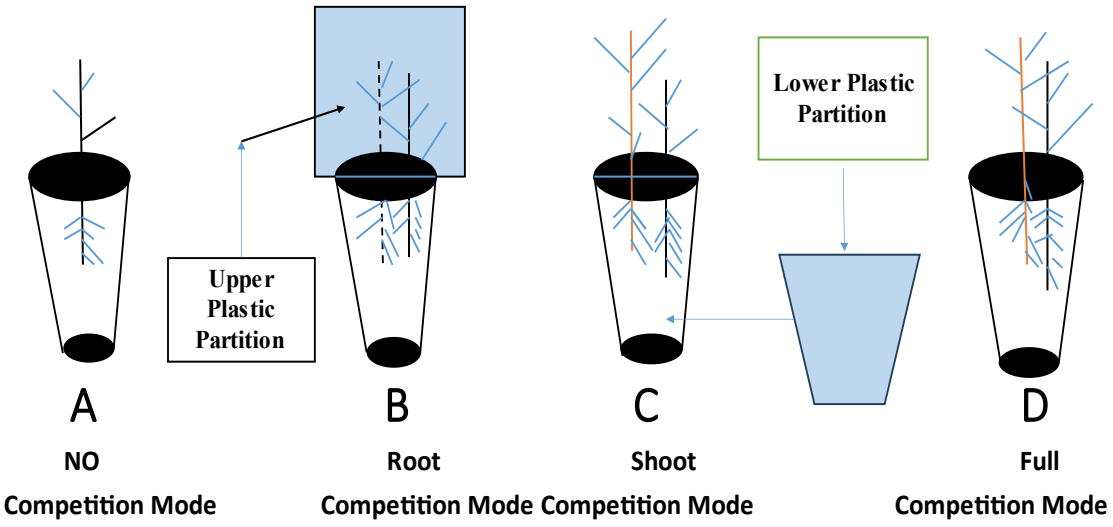

Fig (1): Diagrammatic representation of the planting arrangements

Table (1): Some character of Peatmoss content

Character	Content
NPK	%0
Total Nitrogen	970.2 - 0.45
Water Holding Capacity	%174 - 46
Organic Matter	75
PH	5-7

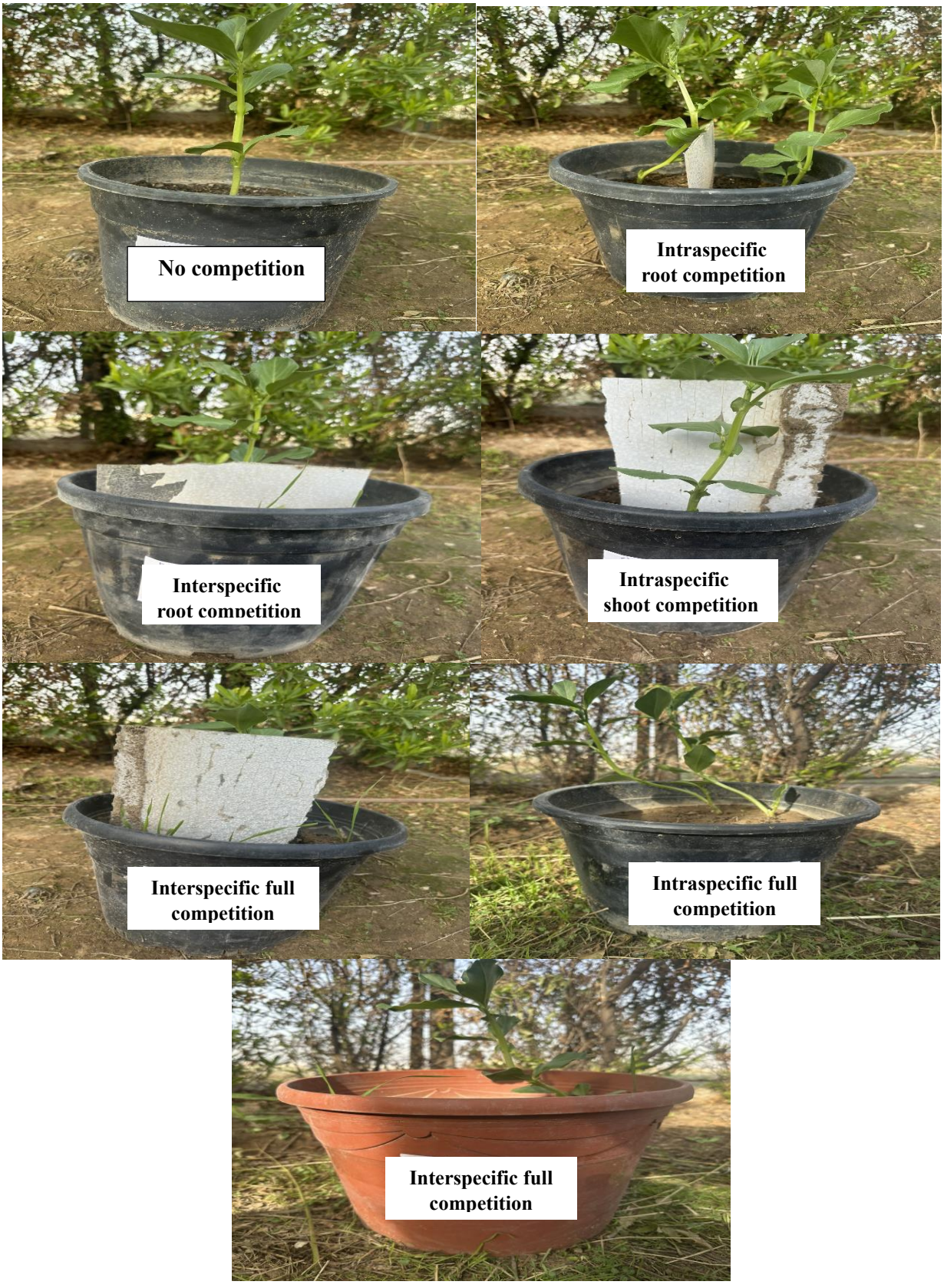

Fig (2): Plant species in the pots experiments

2.1 Experimental Parameters:

1.Vegetative, reproductive and yield component:

1. Plant height (cm)
2. No. of leaves/plant
3. No. of branches/plant
4. No. of pods/plant
5. Green Pod length (cm)
6. Green Pod diameter (cm)
7. Pod weight (g)
8. No. of seeds/pod
9. Seed weight(g)

2. Studied Competition Functions:

The parameters from 1 to 5 were determined using the models shown in each case with the common symbols: (Salih, 2014)

$\mathbf{Y_{aa}}$ = Yield in pure stand of species (a).

$\mathbf{Y_{bb}}$ = Yield in pure stand of species (b).

$\mathbf{Y_{ab}}$ = Mixture yield of species (a) in combination with (b).

$\mathbf{Y_{ba}}$ = Mixture yield of species (b) in combination with (a).

$\mathbf{Z_{ab}}$ = Sown proportion of species (a) in mixture with (b).

$\mathbf{Z_{ba}}$ = Sown proportion of species (b) in mixture with (a).

1. Relative Crowing Coefficient (RCC):

$$\mathbf{RCC_{ab}} = \frac{\mathbf{Yab}}{\mathbf{Yaa - Yab}} \times \frac{\mathbf{Zba}}{\mathbf{Zab}}$$

2. Aggressivity (A):

$$A_{ab} = \frac{Yab}{Yaa \times Zab} - \frac{Yba}{Ybb \times Zba}$$

3. Competition ratio (CR):

$$CR_{ab} = \left(\frac{Yab}{Yaa} \div \frac{Yba}{Ybb} \right) \times \frac{Zba}{Zab}$$

4. Relative Yield Total (RYT):

$$RYT = \left(\frac{Yab}{Yaa} + \frac{Yba}{Ybb} \right) \times \frac{Zba}{Zab}$$

5. Land Equivalent Ratio (LER):

$$LER: La + Lb = \frac{Yab}{Yaa} + \frac{Yba}{Ybb}$$

References

- Abdel-Aal, E. S. M., Ragaee, S., Rabalski, I., Warkentin, T., & Vandenberg, A. (2018). Nutrient content and viscosity of Saskatchewan-grown pulses in relation to their cooking quality. *Canadian Journal of Plant Science, 99*(1),67–77. https://doi.org/10.1139/cjps-2018-0140.
- Craine J. and Dybzinski R. (2013). Mechanisms of plant competition for nutrients, water and light. Functional Ecology, 27: 833–840.
- Hamidi, R. and Mazaheri, D. (2012). Winter Wheat Growth and Yield Influenced by Wild Barley (Hordeum spontaneum Koch) Competition Journal of Agricultural Science, 4(8):190-198.
- Link W., Hanafy M., Malenica N., Jacobsen, H. and Jeleni S. (2009). Faba Bean. JWBK201-Kole. P:1-22.
- Mangla, S., Sheley, R. L. and James, J. (2011). Intra and interspecific competition among invasive and native species during early stages of plant growth. Plant Ecology, 212(4):531-542.
- Salih, R. H. (2014). A Competition Study of two Wheat Varieties (Triticum spp.) with Canary grass (*Phalaris canariensis* L.). M.Sc. Thesis, Salahaddin University – Erbil.
- Schulze, E. D., Beck, E. and Muller-hohenstein, K. (2002) Plant Ecology. Spektrum Akademischer Verlag GmbH, Heidelberg.
- Zimdahl, R. L. (2004). Weed-Crop competition. A Review, 2nd Edition, Blackwell publishing Ltd., Oxford, UK, 220.