

Competitive Indices Between Coriander and Fenugreek Determination as Affected by Intercropping Under Phosphorus Fertilizer

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ABSTRACT:

In order to determine the competitive indices between coriander and fenugreek, a field experiment was established at a Privet Farm, Abo-Hammad District, Sharkia Governorate, Egypt during 2023 and 2024 seasons. Various intercropping systems (sole planting of both crops as control, 1: 1, 2: 2 and 2: 3 as row ratio between coriander: fenugreek, respectively) as well as various phosphorus fertilizer rate (0.0, 15, 30 and 45 kg P₂O₅/feddan) and their combination treatments were tested. The intercropping systems was distributed in main plot while the phosphorus fertilizer rates were placed in subplot in a split plot design with three replicates. The results referred to that the maximum land equivalent ratio (1.35 and 1.39), area \times time equivalent ratio (1.14 and 1.18) and land utilization efficiency (124.56 and 128.90 %) values were obtained under 2: 3 system. Generally, the best combination treatment concern LER (1.43 and 1.41), ATER (1.23 and 1.20) and LUE% (132.87 and 130.76 %) was 2: 3 combined with 15 kg P₂O₅/feddan. Coriander plants were a predominant component (it has a positive signs), while, fenugreek plants were defeated one (it has a negative signs). Likewise, competitive ratio was a greatest for coriander plants compared to the competitive ratio values for fenugreek which recorded the lowest values. From a competitive indices assessment, it could be recommended that intercrop coriander and fenugreek at 2: 3 system and fertilize with phosphorus at 15 kg P₂O₅/feddan was the best farmers agriculture practice for both crops.

Conclusion:

When coriander and fenugreek crops were grown together, the yield increased when phosphorus fertilizer was applied. In all intercropping systems, the competitive indices between coriander and fenugreek were > 1, with 1: 1 or 2: 2 systems fertilized with 15 kg P₂O₅/feddan yielding the highest value. Overall, this research indicates that fenugreek and coriander could be intercropped, particularly in cropping systems with modest phosphorus fertilization.

Keywords: Coriander, fenugreek, intercropping, phosphorus, LER, ATER, LUE

INTRODUCTION:

Egypt is among the world's largest producers, buyers, and exporters of fragrant and medicinal spices. Often called "Cosbara," coriander (*Coriander sativum*) belongs to the Apiaceae family. The primary Egyptian regions where coriander is farmed are Behera, Gharbia, Menoufia, Beni Suef, Menia, New Valley, and Noubaria (**Statistics of the Ministry of Agriculture, 2024**). Coriander is widely farmed in Morocco, Algeria, Iran, Tunisia, southern European countries and South American countries according to **Arslan et al. (2002)**. Fresh coriander is frequently used in salads,

spices, chutneys, and soups because it is high in vitamins A, B₂, and C (Lokesh *et al.*, 2018). Additionally, coriander was utilized to treat anemia and fungal infections, prevent high blood pressure and lower blood sugar, arteriosclerosis, cholesterol as well as control colds, digestion, and diarrhea. Because of its calcium content, it is also used to treat rheumatism and has a major role in the treatment of anemia (Erdogdu, 2012).

Fenugreek, often known as "Helba" (*Trigonella foenum-graceum* L.), belongs to the Leguminosae family. The New Valley is where fenugreek is primarily farmed in Egypt (Ministry of Agriculture Statistics, 2024). Fenugreek's anti-cancer, anti-inflammatory, and analgesic qualities, as well as its ability to lower blood lipids and cholesterol to treat diabetes, have all been documented in traditional medicine (Mandegary *et al.*, 2012). Fenugreek's two most important metabolites, trigonelline and nicotinic acid, are effective therapies for diabetes and high cholesterol. Because of their rich nutritional content, fenugreek grains are used as feed plants and to increase animal milk (Basch *et al.*, 2003).

One way to increase diversity in an agricultural ecosystem is by intercropping. Intercropping is an example of a sustainable agricultural system that seeks to reduce yield damage from weeds, pests, and diseases, improve quality and quantity, increase resource usage, and achieve ecological balance. In contrast to solid cropping, the success of intercrops can be evaluated using a variety of agronomic techniques that affect species combinations. These procedures include intercropping models, planting dates, resource availability and final densities (Gliessman, 1997; Mazaheri *et al.*, 2006; Glaze-Corcoran *et al.*, 2020). A study on fenugreek-based vegetable intercropping is necessary given the importance of vegetable intercropping, the need to double farmers' income owing to current demand, and the fact that fenugreek is the main crop in intercropping systems. Legumes reduce production costs by enabling more effective use of land and other resources. To feed the expanding population, it is imperative to boost agricultural output by inexpensive intercropping (Verma *et al.*, 2021).

Increasing yield is one of the primary objectives of agriculture. Accordingly, crop yield is greatly influenced by plant nutrition, both macro and micro (Dogramaci and Arabaci, 2015). Both more and less fertilizer have a detrimental effect on plant development and productivity. Additionally, aromatic and medicinal plants really benefit from fertilizer. Secondary metabolites and yield measurements are influenced by fertilization techniques and dosages (Srinivasaro, 2021). One of the most crucial macronutrients for plant growth in farmed crops is phosphorus (P) (Zand *et al.*, 2013). Phosphorus is necessary for plant metabolism, including cell division, flower initiation, and fruit or seed maturity, according to Khalid (2012). Additionally, Sonmez (2018) noted that the highest number of seeds per umbel, 1000-seed weight and essential oil content were produced by the 60 kg ha⁻¹ phosphorus application. Therefore, the principle aim of the current study was to determine how various phosphorus fertilization rates and intercropping systems between coriander and fenugreek maximizing the competitive indices of both components.

Materials and Methods:

In order to assess the effects of various phosphorus fertilizer rates (0.0, 15, 30, and 45 kg P₂O₅/feddan) and intercropping systems (sole planting of both crops as control, 1: 1, 2: 2, and 2: 3 as row ratio between coriander: fenugreek, respectively) on competitive indices between them, a field experiment was conducted at a Privet Farm in Abo-Hammad District, Sharkia Governorate, Egypt, during the 2023 and 2024. This experiment used a split-plot design in a complete randomized block design with three replicates for the intercropping system (four systems) and phosphorus fertilizer rate (four rates). Intercropping systems filled the main plot, while phosphorus fertilizer was applied to the subplot. There were sixteen treatments in this trial. The chemical and physical properties of the mixture of the two types of soil that were utilized are listed in Table 1 as described by Chapman and Pratt (1978).

Table 1. Physical and chemical properties of experimental soil (average of two seasons)

physical properties			Soil texture
Clay (%)	Silt (%)	Sand (%)	Clayly

58.37		24.72		16.91						
Chemical properties										
E.C. dSm ⁻¹	pH	CaCO ₃ (%)	Organic matter (%)	Soluble cations (meq./L)				Soluble anions (meq./L)		
				Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺	HCO ₃ ⁻	Cl ⁻	SO ₄ ⁻
2.27	7.87	0.39	1.07	12.18	9.77	6.14	5.43	7.88	7.17	18.47
Available nutrient (mg kg ⁻¹ soil)										
N	P	K	Fe	Zn	Mn	Cu				
36.42	29.74	180.50	1.71	0.59	0.39	0.60				

Sowing and experimental unit:

Twelve rows spaced 60 cm apart made up the experimental unit. Two coriander plants per hill were sown on each side of the row at a distance of 30 cm, and fenugreek plants were sown on both sides of the row at a distance of 30 cm. In the winter seasons of 2023 and 2024, coriander fruits and fenugreek seeds were seeded on October 24 and 29. The intercropping systems included sole planting of each crop as a control, one coriander row alternating with one fenugreek row (1: 1 system), two coriander rows alternating with two fenugreek rows (2: 2 system), and two coriander rows alternating with three fenugreek rows (2: 3 system). Throughout the experimental setup, different phosphorus rates (0.0, 15, 30, and 45 P₂O₅/feddan) were supplied as a soil drench. Super calcium phosphate (15% P₂O₅) was used as the phosphorus fertilizer source, and it was distributed across sub-plots. The two crops (fenugreek and coriander) received standard agricultural practices (fertilization, irrigation, pest and disease resistance, etc.) when needed.

Competitive indices determined:

1. Land equivalent ratio (LER): It was determined for coriander and fenugreek yield calculated per feddan according to the following equation:

$$LER = Lc + Lf$$

$$Lc = \frac{Y_{cf}}{Y_{cc}} \quad , \quad Lf = \frac{Y_{fc}}{Y_{ff}}$$

Where, Y_{cc} and Y_{ff} are the yields per feddan of coriander and fenugreek, respectively, as sole crops, Y_{cf}, and Y_{fc} are the yields of coriander and fenugreek, respectively, as intercrops (**Mead and Willey, 1980**).

2. Area × Time Equivalent Ratio (ATER): It was calculated according to the following equation:

$$ATER = \frac{Y_{cf} / Y_{cc} \times t_c + Y_{fc} / Y_{ff} \times t_f}{T}$$

Where: Y_{cf} = Intercrop yield of coriander, Y_{cc} = Sole yield of coriander, Y_{fc} = Intercrop yield of fenugreek, Y_{ff} = Sole yield of fenugreek, t_c = the duration of coriander in days, t_f = The duration period of fenugreek in days and T = The total duration of intercropping system in days (**Hiebsch and McCollum, 1987**).

3. Land Utilization Efficiency percentages (LUE %): The land utilization efficiency percentage (LUE %) was calculated by utilizing each LER and ATER values, according to (**Mason et al., 1986**) equation as next:

$$\text{LUE \%} = \frac{\text{LER} + \text{ATER}}{2} \times 100$$

4. Aggressivity (A) value: it was calculated according to **Mc Gilchrist (1965)** equation as follows:

$$\text{Acf} = \frac{Y_{cf}}{Y_{cc} \times Z_{cf}} - \frac{Y_{fc}}{Y_{ff} \times Z_{fc}}, \quad \text{Afc} = \frac{Y_{fc}}{Y_{ff} \times Z_{fc}} - \frac{Y_{cf}}{Y_{cc} \times Z_{cf}}$$

Where, Y_{cf} = Intercrop yield of coriander, Y_{fc} = Intercrop yield of fenugreek, Y_{cc} = Sole yield of coriander, Y_{ff} = Sole yield of fenugreek, Z_{cf} = Sowing proportion of coriander and Z_{fc} = Sowing proportion of fenugreek.

5. Competitive ratio (CR): It's another indicator to detect how competitive various species. The competitive ratio (CR) is a preferable indicator of a crop's competitive aptitude, and it may also be utilized to compare aggressively (**Willey and Rao, 1980**). The competitive ratio marks the percentage of the two crops in which they are primarily seeded by calculating the ratio of relative yield of every crop. The following equation is utilized to calculate the CR:

$$\begin{aligned} \text{CR coriander} \times \text{fenugreek} &= \frac{L_c}{L_f} \times \left(\frac{Z_{fc}}{Z_{cf}} \right) \\ \text{CR fenugreek} \times \text{coriander} &= \frac{L_f}{L_c} \times \left(\frac{Z_{cf}}{Z_{fc}} \right) \end{aligned}$$

Statistical Analysis:

The recorded data were statistically analyzed according to **Gomez and Gomez (1984)**, and the recorded means were compared utilizing Statistix software version 9 (**Analytical software, 2008**).

RESULTS AND DISCUSSION:

Effect of Intercropping systems:

Results recorded in Table 2, 3 and 4 indicate that coriander and fenugreek intercropped in 2: 3 system had higher land equivalent ratios (LER), area \times time equivalent ratio (ATER) and land utilization efficiency (LUE %) values (1.35 and 1.39; 1.14 and 1.18 and 124.56 and 128.90 %) in the first and second seasons, respectively. This indicates that this intercropping system (2: 3) was advantageous for utilizing environmental resources. As can be seen from the aforementioned figures, which were more than 1.00, coriander and fenugreek intercropping at 1: 1, 2: 2, and 2: 3 was in fact more productive than growing them in sole planting system. The most popular explanation for this problem, according to **Natarajan and Willey (1980)**, is that growth resources should be employed rather differently so that they "complement" one another and make efficient use of resources when grown together rather than separately. These results supported the widely held belief that plants gain from the direct transfer of fixed N₂ in legume/non-legume intercropping systems (**Graham and Vance, 2000**). In addition, similar results were reported by **Abdelkader and Hassan (2016)** on dill when intercropped with fenugreek, **Boori et al. (2018)** on fennel when intercropped with fenugreek and **Dubey et al. (2023)** on chilli when intercropped with fenugreek.

According to Tables 5 and 6, an aggressivity score of 0 denotes equal competitiveness between the component crops. In any other situation, two crops will have the same numerical value, with the vanquished crop having a negative value and the dominating crop having a positive one. A greater numerical value denotes a more pronounced difference in competitive abilities. The aggressor crop in every intercropping scheme was the coriander component inter-planted with fenugreek (Ag for coriander).

Table 2. Effect of intercropping system (I), phosphorus rate (P) and their interactions (I×P) on land equivalent ratio (LER) between coriander and fenugreek plants during 2023 and 2024 seasons

Intercropping system (Coriander: Fenugreek as row ratio)	Phosphorus fertilizer rate (kg P ₂ O ₅ /feddan)				Mean (I)
	Control	15	30	45	
1st season					
Sole crop	1.00	1.00	1.00	1.00	1.00
1: 1	1.09	1.24	1.24	1.23	1.20
2: 2	1.12	1.24	1.25	1.26	1.22
2: 3	1.27	1.43	1.31	1.37	1.35
Mean (P)	1.12	1.23	1.20	1.21	
L.S.D. at 5 %	For (I)= 0.02	For (P)= 0.02		For (I×P)= 0.04	
2nd season					
Sole crop	1.00	1.00	1.00	1.00	1.00
1: 1	1.14	1.21	1.24	1.22	1.20
2: 2	1.17	1.20	1.31	1.32	1.25
2: 3	1.35	1.41	1.43	1.39	1.39
Mean (N)	1.16	1.21	1.25	1.23	
L.S.D. at 5 %	For (I)= 0.02	For (P)= 0.02		For (I×P)= 0.04	

Table 3. Effect of intercropping system (I), phosphorus rate (P) and their interactions (I×P) on area× time equivalent ratio (ATER) between coriander and fenugreek plants during 2023 and 2024 seasons

Intercropping system (Coriander: Fenugreek as row ratio)	Phosphorus fertilizer rate (kg P ₂ O ₅ /feddan)				Mean (I)
	Control	15	30	45	
1st season					
Sole crop	0.85	0.85	0.85	0.85	0.85
1: 1	0.94	1.07	1.07	1.07	1.04
2: 2	0.97	1.09	1.08	1.08	1.06
2: 3	1.06	1.23	1.12	1.17	1.14
Mean (P)	0.96	1.06	1.03	1.04	
L.S.D. at 5 %	For (I)= 0.02	For (P)= 0.02		For (I×P)= 0.04	
2nd season					

Sole crop	0.85	0.85	0.85	0.85	0.85
1: 1	0.98	1.04	1.08	1.06	1.04
2: 2	1.01	1.05	1.14	1.15	1.09
2: 3	1.13	1.20	1.22	1.18	1.18
Mean (N)	0.99	1.04	1.07	1.06	
L.S.D. at 5 %	For (I)= 0.02	For (P)= 0.02	For (I×P)= 0.04		

Table 4. Effect of intercropping system (I), phosphorus rate (P) and their interactions (I×P) on land utilization efficiency (LUE %) between coriander and fenugreek plants during 2023 and 2024 seasons

Intercropping system (Coriander: Fenugreek as row ratio)	Phosphorus fertilizer rate (kg P ₂ O ₅ /feddan)				Mean (I)
	Control	15	30	45	
1st season					
Sole crop	92.52	92.52	92.52	92.52	92.52
1: 1	101.56	115.56	115.47	115.04	111.91
2: 2	104.73	116.77	116.08	117.08	113.66
2: 3	116.84	132.87	121.49	127.06	124.56
Mean (P)	103.91	114.43	111.39	112.92	
L.S.D. at 5 %	For (I)= 1.88	For (P)= 1.92	For (I×P)=		
2nd season					
Sole crop	92.52	92.52	92.52	92.52	92.52
1: 1	105.91	112.37	115.74	114.04	112.02
2: 2	109.00	112.51	122.37	123.76	116.91
2: 3	123.87	130.76	132.69	128.28	128.90
Mean (N)	107.82	112.04	115.83	114.65	
L.S.D. at 5 %	For (I)= 1.62	For (P)= 2.06	For (I×P)=		

Table 5. Effect of intercropping system (I), phosphorus rate (P) and their interactions (I×P) on aggressivity values for coriander between coriander and fenugreek plants during 2023 and 2024 seasons

Intercropping system (Coriander: Fenugreek as row ratio)	Phosphorus fertilizer rate (kg P ₂ O ₅ /feddan)				Mean (I)
	Control	15	30	45	

1st season					
Sole crop	+ 0.000	+ 0.000	+ 0.000	+ 0.000	+ 0.000
1: 1	+ 0.047	+ 0.290	+ 0.277	+ 0.292	+ 0.226
2: 2	+ 0.213	+ 0.444	+ 0.220	+ 0.256	+ 0.283
2: 3	+ 0.258	+ 0.701	+ 0.569	+ 0.595	+ 0.531
Mean (P)	+ 0.130	+ 0.359	+ 0.266	+ 0.286	
L.S.D. at 5 %	For (I)= 0.027	For (P)= 0.042	For (I×P)= 0.077		
2nd season					
Sole crop	+ 0.000	+ 0.000	+ 0.000	+ 0.000	+ 0.000
1: 1	+ 0.087	+ 0.266	+ 0.286	+ 0.256	+ 0.214
2: 2	+ 0.246	+ 0.326	+ 0.300	+ 0.331	+ 0.301
2: 3	+ 0.403	+ 0.582	+ 0.663	+ 0.536	+ 0.546
Mean (N)	+ 0.184	+ 0.284	+ 0.312	+ 0.281	
L.S.D. at 5 %	For (I)= 0.036	For (P)= 0.040	For (I×P)= 0.078		

Table 6. Effect of intercropping system (I), phosphorus rate (P) and their interactions (I×P) on aggressivity values for fenugreek between coriander and fenugreek plants during 2023 and 2024 seasons

Intercropping system (Coriander: Fenugreek as row ratio)	Phosphorus fertilizer rate (kg P₂O₅ /feddan)				Mean (I)
	Control	15	30	45	
1st season					
Sole crop	- 0.000	- 0.000	- 0.000	- 0.000	- 0.000
1: 1	- 0.047	- 0.290	- 0.277	- 0.292	- 0.226
2: 2	- 0.213	- 0.444	- 0.220	- 0.256	- 0.283
2: 3	- 0.258	- 0.701	- 0.569	- 0.595	- 0.531
Mean (P)	- 0.130	- 0.359	- 0.266	- 0.286	
L.S.D. at 5 %	For (I)= 0.027	For (P)= 0.042	For (I×P)= 0.077		
2nd season					
Sole crop	- 0.000	- 0.000	- 0.000	- 0.000	- 0.000
1: 1	- 0.087	- 0.266	- 0.286	- 0.256	- 0.214
2: 2	- 0.246	- 0.326	- 0.300	- 0.331	- 0.301
2: 3	- 0.403	- 0.582	- 0.663	- 0.536	- 0.546

Mean (N)	- 0.184	- 0.284	- 0.312	- 0.281
L.S.D. at 5 %	For (I)= 0.036	For (P)= 0.040	For (I×P)= 0.078	

The highest Ag aggressivity values for coriander plants were 0.531 and 0.546 with a 2:3 intercropping system, while the corresponding values for Ag fenugreek plants were -0.531 and -0.546 in the first and second seasons, respectively. Likewise, in all intercropping systems under study the values of competitive ratio (Tables 7 and 8) for coriander were greater than for fenugreek showing the dominance of coriander. In the same line, **Li *et al.* (2024)** found that tiger nuts (*Cyperus esculentus* L.) crop was the dominant, whereas maize, soybean and cotton were the defeated ones.

Effect of phosphorus rates:

With any application of phosphorus fertilizer, all LER, ATER, and LUE % values were larger than one (Tables 2, 3 and 4). When compared to control, phosphorus rates have a considerable impact on the land equivalent ratio, area × time equivalent ratio, and land utilization efficiency. The aggressivity numbers clearly show that coriander was the dominant crop and fenugreek was the defeated one (Tables 5 and 6). Furthermore, the main factor influencing the advantage of growing coriander and fenugreek together is the level of intra-crop versus inter-crop competition. Tables 7 and 8 show that coriander plants were more competitive (CR coriander > one) than fenugreek plants (CR fenugreek < one) in all phosphorus fertilizations. When companion crops use growth nutrients (such phosphorus) differently, there is less inter-crop competition compared to intra-crop competition.

Table 7. Effect of intercropping system (I), phosphorus rate (P) and their interactions (I×P) on competitive ratio for coriander between coriander and fenugreek plants during 2023 and 2024 seasons

Intercropping system (Coriander: Fenugreek as row ratio)	Phosphorus fertilizer rate (kg P₂O₅ /feddan)				Mean (I)
	Control	15	30	45	
1st season					
Sole coriander	1.00	1.00	1.00	1.00	1.00
1: 1	1.04	1.27	1.25	1.27	1.21
2: 2	1.21	1.43	1.19	1.23	1.27
2: 3	1.22	1.61	1.52	1.53	1.47
Mean (P)	1.12	1.33	1.24	1.26	
L.S.D. at 5 %	For (I)= 0.02	For (P)= 0.04	For (I×P)= 0.07		
2nd season					
Sole coriander	1.00	1.00	1.00	1.00	1.00
1: 1	1.08	1.21	1.26	1.23	1.19
2: 2	1.24	1.31	1.26	1.29	1.27
2: 3	1.34	1.49	1.57	1.46	1.46
Mean (N)	1.16	1.25	1.27	1.24	

L.S.D. at 5 %	For (I)= 0.03	For (P)= 0.04	For (I×P)= 0.07
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Table 8. Effect of intercropping system (I), phosphorus rate (P) and their interactions (I×P) on competitive ratio for fenugreek between coriander and fenugreek plants during 2023 and 2024 seasons

Intercropping system (Coriander: Fenugreek as row ratio)	Phosphorus fertilizer rate (kg P ₂ O ₅ /feddan)				Mean (I)
	Control	15	30	45	
1st season					
Sole crop	1.00	1.00	1.00	1.00	1.00
1: 1	0.96	0.79	0.80	0.79	0.83
2: 2	0.83	0.70	0.84	0.82	0.79
2: 3	0.82	0.62	0.66	0.66	0.70
Mean (P)	0.90	0.78	0.82	0.81	
L.S.D. at 5 %	For (I)= 0.02	For (P)= 0.03	For (I×P)= 0.05		
2nd season					
Sole crop	1.00	1.00	1.00	1.00	1.00
1: 1	0.93	0.83	0.79	0.81	0.84
2: 2	0.81	0.76	0.80	0.78	0.78
2: 3	0.75	0.67	0.64	0.69	0.69
Mean (N)	0.87	0.82	0.81	0.82	
L.S.D. at 5 %	For (I)= 0.02	For (P)= 0.02	For (I×P)= 0.04		

Phosphorus has remarkable effects on the growth parameters of coriander and fenugreek plants since it is a part of the molecular structure of essential chemicals like DNA and RNA (Marshner, 1995). Additionally, it is essential for photosynthesis, cell division, and meristem tissues. Several types of phosphate fertilizers are added to the soil to make up for the P deficit because legumes have a greater capacity to consume phosphorus than other crops (Gentili et al., 2006). Abusuwar and Omer (2011) reported similar outcomes when *Clitoria ternatea* was inter-planted with *Lablab purpureus* and fertilized with phosphorus and Abdelkader and Hassan (2016) observed similar outcomes when dill was inter-planted with fenugreek and fertilized with phosphorus.

Effect of combination between intercropping and phosphorus:

In both seasons, the combination treatment of 15 kg P₂O₅/feddan with an intercropping method (two rows of coriander alternating with three rows of fenugreek) yielded the highest LER (1.43 and 1.41), (1.23 and 1.20) and LUE% (132.87 and 130.76 %), respectively (Tables 2, 3 and 4). Based on this data, it is possible to produce the same yield from one feddan utilizing this intercropping systems and 15 kg P₂O₅/feddan, which would take roughly 1.43 or 1.41 feddan if each crop were grown alone. As shown in Tables 5 and 6 when a 2:3 intercropping system treatment and 15 and 30 kg of P₂O₅ per feddan were utilized in the 1st and 2nd seasons, respectively, the aggressivity achieved its maximum values (0.701 and 0.663). According to the results above, the superiority in coriander and fenugreek fruit

and seed yield by phosphorus fertilizer application can be directly attributed to the plants' improved yield components. Furthermore, competitive ratio was greater than one with coriander while it was lower one in fenugreek, clearing the coriander was more competitive than fenugreek under all interaction treatments during the both seasons (Tables 7 and 8).

This led to increases in metabolites synthesized to fruits and seeds, which in turn increased the total yield of coriander and fenugreek fruit and seeds, respectively. Phosphorus fertilization enhances growth and yield in non-legume intercropping systems while legume-based intercropping may be more favorable under low phosphorus availability conditions (**Rahman *et al.*, 2025 and Tao *et al.*, 2025**).

Conclusion:

When coriander and fenugreek crops were grown together, the yield increased when phosphorus fertilizer was applied. In all intercropping systems, the competitive indices between coriander and fenugreek were > 1 , with 1: 1 or 2: 2 systems fertilized with 15 kg P₂O₅/feddan yielding the highest value. Overall, this research indicates that fenugreek and coriander could be intercropped, particularly in cropping systems with modest phosphorus fertilization.

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