Nat. Volatiles & Essent. Oils, 2022; 9(2): 667-674

NVEO
Natural Volatiles &
Essential Oils

Competitive Nature In The Corn And Cowpea Intercropping Systems

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Abstract

The field experiment was conducted in the spring agricultural season 2020 in one of the agricultural fields in Al-Alam district, north of Tikrit. The field was divided into three replicates, each replicate included eight experimental units in a randomized complete block design RCBD, and each experimental unit included 12 centers, the distance between them was 0.75 m and the length of 3 m. The distance between one pit and another in the yellow corn (popcorn) was 20 cm, while it was 25 cm in the cowpea crop. The results showed that the average values of Lb for cowpea crop are greater than La values for corn in all intercropping systems. This means that the use of cowpea for the available growth requirements of soil, climate, fertilizer and water in intercropping is better than corn, It gave the highest Lb values for cowpea in intercropping systems (1 corn: 3 cowpeas) and (3 corn: 3 cowpeas) amounting to 0.82 and 0.76, respectively. It is noted that the LER Land Equivalent values were better than Monocropping in intercropping systems (1 corn: 3 cowpeas).) and (2 corn: 3 cowpeas) and (3 corn: 3 cowpeas), as the LER values were higher than the correct one and reached 1.1 and 1.0, and the highest value was 1.72 in the loading system (3 corn: 3 cowpeas),This is an indication that intercropping systems whose LER values are higher than one are better at making use of the available environmental conditions and growth requirements.

Keywords: intercropping, productivity indicators, popcorn, cowpea

Introduction

The mixtures cultivation is very necessary in order to provide feed in the appropriate quantity and quality, as well as to benefit from the same land, where more than two crops are grown per unit area and in the same year (Qajo, 2014). Also, the loading system increases the proportion of the land reward, which is the relative unit of land that is exploited by cultivated both crops as if they were cultivated separately to produce the same crop. The loading system for grain crops and legume crops leads to mutual benefits between these crops when planted together. The non-legume crop benefits from atmospheric nitrogen fixed by the leguminous crop (Franche et al. 2009).At the same time, the leguminous crop benefits from the presence of the accompanying non-leguminous crop in one soil through changes in conditions as well as the secretions of roots of all kinds. (Hassan, 2004) noted the excelled of using the corn crop loading system with Peanut in plant height and leaf area as found (Ouda and others 2007).The system of inter-cropping has been used for a long time in the tropics, because it increases the total productivity per unit area by making the most of land, labor and land resources Mead and Willy (1980), Shen and Chu (2004), Craufard (2000). Ezumah and Ikeorgu (2008) indicated that in intercropping, corn and cowpea crops compete only when nutrients are added to the soil, while when

they are not added, each of them searches for nutrients from other sources. The estimation of the land yield is made from the yield of Monocropping and intercropping, and this calculated figure is called the Land LER Equivalent Ratio. In the intercropping system, the returns to Monocropping are divided by the returns to each crop and the numbers are added together, Mitlleider and Nelson (1970). This study aims to evaluate the growth and yield of corn and cowpea under the influence of the intercropping system and to estimate the yield indicators.

Materials and methods

The field experiment was conducted during the spring agricultural season in one of the agricultural fields in Al-Alam district, north of the city of Tikrit, where the land was plowed by two perpendicular Tillage using the Moldboard plows and it was smoothed with harrows and leveled, and the experiment field was divided into furrow and then the field was divided into three replicates, each replicate included eight experimental units. The treatments were randomly assigned to them by randomized complete blocks design(RCBD). Each experimental unit included 12 seedlings, the distance between them was 0.75 m, and the length of 3 m. The distance between one pit and another in yellow corn was 20 cm, while it was 25 cm in the cowpea crop. Three seeds were placed in each pit to ensure full germination, with a depth of 3-5 On one side of the furrow, the thinning process was conducted two weeks after germination, in order to preserve the strongest plants in each pit .The loading percentages were determined, which depended on the number of furrows exchanged in cultivation at each experimental unit. The experiment was cultivated on 3/18/2020 according to the experimental design.Phosphate fertilizer was added in the form of triple superphosphate fertilizer (P2 O5 46%) at a rate of 240 kg ha-1 in one batch before planting, and the experiment was watered as needed during the growing season, and manual weeding was conducted several times as required during the growing season an amount of urea fertilizer (46/N) was added in two batches, one batch at cultivated and the other batch after 45 days of planting at an average of 320 kg ha^{-1} after hoeing and weeding the experiment (Ali, 2012), the corn stem borer (Sesamia cretica) was exposed and by using the granular diazinon pesticide (10%) at a rate of (6) kg.ha-1 after (30) days of germination, feeding at the top of the plant and twice after (20-25) days of planting, and the second after two weeks of the first control (Al-Barzanji , 2006). Indicators of the efficiency of intercropping systems for loaded crops were taken:

1- (LER) Land Equivalent Ralio

According to (Willey and Osiru, 1972).

2- Crop Performance Ratio (CPR)

According to (Azam et al. 1990).

3- Relative Crowding Coefficient (RCC or K)

According to (De Wit 1960).

4- Land Equivalent Coefficient (LEC)

It is a measure suggested by (Adeliloye et al. 1983).

5- Competitive Ratio (CR)

According to (Awad and Al-Najjar, 2016)

6- Aggressivity index (A)

Developed this scale (McGilchrit .1965).

7- Monetary Advantage Index (MAI)

Developed by Willey.1979.

Results and discussion

Table (1) shows that the average values of Lb for cowpea crops are greater than La values for corn in all intercropping systems. This means that the use of cowpea for the available growth requirements of soil, climate, fertilizer, and water in intercropping is better than corn, and it gave the highest values of Lb for cowpea in intercropping systems. Loading (1 corn: 3 cowpeas) and (3 corn: 3 cowpeas) were 0.82 and 0.76, respectively. It is noted that the values of the ground equivalent LER were better than Monocropping in the intercropping systems (1 corn: 3 cowpeas), (2 corn: 3 cowpeas) and (3 corn: 3 cowpeas), as the LER values were higher than the correct one and were 1.1 and 1.0 and the highest value was 1.72 in the loading system (3 corn: 3 cowpeas), This is an indication that the intercropping systems whose LER values are higher than one are better at making use of the available environmental conditions and growth requirements, and this is consistent with Rastgo et al. (2015), as it was found that the LER index was more than one in some intercropping systems, which It has an advantage on Monocropping. It also corresponds with El-Karamity et al. (2020), which indicated the importance of intercropping corn with some leguminous crops with different levels of fertilizer, and the highest value of LER was when planting corn with field pistachios at the level of 75% nano fertilizer and 25% mineral fertilizer. Table (1) notes that the CRP values, which indicate the variation in the crop efficiency of intercropped crops compared to Monocropping in the same unit area of the land, is a reflection of the transfer of environmental resources from nutrients, light and water to the economic part, which is grain.It is noted that the CPR values were all greater than one in all intercropping systems, which indicates a crop advantage for these systems. The highest values of the crop efficiency ratio (CPR) in the loading system (1 corn: 3 cowpeas) and (3 corn: 3 cowpeas) reached 3.58. and 3.75, respectively, and they correspond to the LER . values

Table (1) Values of competitive indicators of corn and cowpea crops in intercropping compared to monoculture of both for the economic yield of the two crops

Monetary Advantage Index (MAI)	Aggressivity index (A)		Competitive Ratio (CR)		Land Equivalent Coefficient (LEC)	Relative Crowding Coefficient (RCC or K)			Crop Performance Ratio			Land Equivalent Ralio			Treatments
MAI	A ba	A ab	CR b	CR a	LEC	K or RCC	K ba	K ab	CPR ab	CP R b	CP R a	LE R	L b	L a	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(corn alone)
687917	0.02	-0.02	1.06	0.94	0.16	0.47	0.72	0.65	1.58	1.67	1.57	0.81	0.42	0.39	(1 corn: 1 cowpeas)
809871	0.45	-0.45	1.45	0.69	0.16	-120.92	-53.16	2.27	1.99	1.53	2.08	0.91	0.68	0.23	(1 corn: 2 cowpeas)
794005	0.00	0.00	0.99	1.01	0.18	0.55	0.73	0.74	1.71	1.69	1.71	0.85	0.42	0.43	(2 corn: 2 cowpeas)
1236144	0.55	-0.55	1.01	0.99	0.22	142.41	-11.13	-12.79	3.56	1.46	1.45	1.10	0.82	0.27	(1 corn: 3 cowpeas)
1041572	0.27	-0.27	1.16	0.86	0.23	-198.07	-19.59	10.11	1.92	1.76	1.52	1.00	0.63	0.36	(2 corn: 3 cowpeas)
2786444	-0.19	0.19	0.80	1.25	0.73	73.39	3.25	22.56	3.75	3.06	3.83	1.72	0.76	0.96	(3 corn: 3 cowpeas)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(cowpeas alone)

whereas:

La = the relative yield of type (A) Pop Corn.

Lb = the relative yield of type (b) cowpea.

CPR a = corn Crop Performance Ratio.

CPR b = Cowpea Crop Performance Ratio.

K ab = Relative Crowding Coefficient or Competitive Ratio of corn crop.

K ba = Relative Crowding Coefficient or Competitive Ratio of cowpea crop.

CR a =Competitive Ratio of corn crop.

CR b = Competitive Ratio of cowpea crop.

A ab = Aggressiveness of corn crop on cowpea crop.

A ba = Aggressiveness of cowpea crop on corn crop.

The values of LER are higher than the correct one, and the crop performance ratio of corn varied, where it was excelled in intercropping systems (1 corn: 2 cowpeas) and (2 corn: 2 cowpeas), while cowpea excelled in its performance ratio in intercropping systems (1 corn: 1 cowpea) and (1 corn: 3 cowpeas), (2 corn: 3 cowpeas) and (3 corn: 3 cowpeas) and this indicates that the cultivation of cowpea in three lines provides an opportunity for this crop to better exploit the natural and added resources, The results of the relative crowding coefficient (RCC) shown in Table (1), which were calculated according to (De Wit, 1960) law, are sometimes called the environmental ability to compete as well. It is also called the inter-compaction coefficient. It appears from the table that the value of the RCC of the corn was higher than the value of the RCC of the cowpea in most of the intercropping systems, and the highest value was 22.56 in the loading system (3 corn: 3 cowpeas). It is noticed that the yield of cowpea decreased in intercropping systems (1 corn: 2 cowpeas), (1 corn: 3 cowpeas) and (2 corn: 3 cowpeas) amounting to (53.16 - 11.13 - and -19.59).This is because its RCC values were less than the correct unit, while the grain yield decreased in corn in the loading system (1 corn: 3 cowpeas), because the RCC value of corn was less than the correct one and amounted to -12.79.The loading system was the best in competitive ratio due to the high RCC values, which amounted to 142.41 and 73.39 in the loading system (1 corn: 3 cowpeas) and (3 corn: 3 cowpeas), while the competitive ability decreased in the loading system (1 corn: 2 cowpeas) and (2 Corn: 3 cowpeas) because the RCC values are less than one and reached (-120.92 and -198.07).These results are in line with Rastgo et al. (2015), who indicated that sesame has a higher competitive ability than Mung cowpeas, and Donyavian et al. (2018), who found that the values of the Aggressivity factor for cotton are greater than the mobilization factor for sesame and were in the positive direction in certain patterns and negative ones in other intercropping systems and indicated that the positive sign is an indication of an increase in the yield of the crop more than its average. Table (1) shows that the Land Equivalent Coefficient LEC, which was proposed by Adetitoye et al. 1983, which indicated the limits of productivity with a value of 0.25 and its increase, is good, meaning if the value is higher than 0.25, the loading system has a crop advantage compared to Monocropping, It is noted that all intercropping systems were below 0.25 except for the loading system (3 corn: 3 cowpeas), where the value of the land equivalent LEC was (0.73) and this is an

indication of the efficiency of this system of loading and has a high yield advantage compared to Monocropping and was compatible in this system, which gave the highest LER value consistent with El-Karamity et al. (2020) and Gendy et al. (2013).They indicated that the crop advantage that corresponds to high LER values and greater than one is the result of the ability of this system to exploit different growth resources above and below the ground, which results in a leafy surface and morphological traits of local plants and thus leads to an increase in the values of the land equivalent LEC.It is noticed from Table (1) that the values of the CR Competitive for the crop of corn intercropping in cultivation with cowpea were higher than the correct one in the loading system (2 corn: 2 cowpeas) and (3 corn: 3 cowpeas), which amounted to (1.01 and 1.25) on the this is an indication of the dominance of corn plants in the above intercropping systems on cowpea plants and that they are more competitive. While it is noted that in the intercropping systems (1 corn: 1 cowpea), (1 corn: 2 cowpeas), (1 corn: 3 cowpeas) and (2 corn: 3 cowpeas) the CR values of cowpea were higher than the correct one, and this indicates that plants Cowpea is more competitive than corn and has a crop advantage and control in utilizing the available resources and making use of it. Cowpea plants achieve more than their rates in these intercropping systems. These results are consistent with El-Karamity et al. (2020) and Donyavian et al. (2018), who indicated that the competitive ratio of sesame and cotton crops varies according to different intercropping systems on sesame plants.

4 - 3 - 7 monetary advantage index (MAI):

It appears in Table (1) that the following MAI values refer to the monetary advantage index for intercropping systems, whose positive values indicate that intercropping systems have a cash return and a crop advantage compared to Monocropping, especially if it is negative, the monetary advantage indicates no profit and intercropping systems have no crop advantage, Where we note that the MAI values in all intercropping systems were positive and ranged from 794,005 dinars in the loading system (2 corn: 2 cowpeas) to 2786444 dinars in the loading system (3 corn: 3 cowpeas), which gave the highest values for competitive indicators, followed by the loading system (1 corn: 3 cowpeas), which gave 1236,144 dinars, and it corresponds to El-Ghobashy et al. (2020), finding the highest total yield when planting corn with cowpeas, inter-cropping with rationalization in fertilization rates

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