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EFFECT OF PRECEDING WINTER CROPS AND INTERCROPPING ON YIELD, YIELD COMPONENTS AND ASSOCIATED WEEDS IN MAIZE

BY

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ABSTRACT

This study was carried out at Mallawi Agriculture Research Station to study the effect of preceding winter crops (wheat, fababean, berseem and onion) and cropping systems (maize intercropped with cowpea and solid maize) on yield, yield components and associated weeds in maize cultivar T.W.C. 310. The trial was initiated in 2003 season and completed in 2004 season, using a split-plot design with three replications. The result clear that: Maize, cowpea and associated weeds were significantly affected by preceding crops in both seasons. Planting maize after legume crops (fababean or berseem) produced the highest values for all characteristics. The lowest values were observed when it grown after wheat. The increase in maize grain yield after fababean were 19.09 and 17.33% in the first and second seasons, respectively, compared with maize grain yield grown after wheat. The highest yield of cowpea (4.00 and 3.80 t/fed) were observed when the preceding crop was berseem, while the lowest values (3.00 and 3.20 t/fed) were observed when wheat was the preceding crop in both seasons. The effect of preceding crops on fresh weight of weeds associated with maize grown after berseem was the less followed by that grown after fababean as compared with that grown after wheat or onion. The yield and yield components of maize were increased when intercropped with cowpea in both seasons. The increase in grain yield was 3.74 and 5.05% in the first and the second seasons, respectively, compared with solid maize. The highest values of weeds weight (2.97 and 2.74 kg/m^2) were observed in solid maize grown after wheat while the lowest values (1.61and 1.61 kg/m^2) were observed in intercropped maize with cowpea and preceded by berseem in first and second seasons, respectively.

It could be concluded that maize grown after legume crops and intercropped with cowpea produce the highest grain yield and lowest values of associated weeds.

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important food and feed crops in Egypt. Increasing maize production can be achieved through planting maize after legume crops, weed control and intercropping are among the factors of raising maize crop production. Several researchers showed that grain yield of maize grown after legume crops surpassed that grown after non legume crops.

(Mac coll. (1991),El-Hawary *et al.* (1994), Abou-kresha *et al.* (1998) and El-Douby. (2002)).

Mac coll. (1991) reported that cereal yields superiority after legume crop have been attributed to less N-uptake by the legume and increasing residual organic matter. El-Hawary *et al.* (1994) showed that berseem as preceding crop enhanced the number of branches and pods/plant, number of seeds/pod, weight of seeds/plant, seed index of soybean whereas, wheat as winter preceding crop had less effect on soybean plants. Abou-kresha *et al.* (1998) indicated that preceding crops had a significant effected on number of kernels/row, weight of kernels/ear, 100 kernels weight and grain yield of maize. They farther added that yield of maize and soybean grown after berseem or fababean were significantly higher than that grown after wheat by 35.4 and 43.0 % for maize and 28.3 and 35.6% for soybean, respectively. El-Doby. (2002) reported that all maize characters under study were significantly affected by preceding crops in both seasons except number of rows/ear and shilling percentage. Maize planting after Egyptian clover produced the highest values for these characteristics followed by wheat and sugar beet.

Intercropping methods also can affect on grain yield of maize. Gunasena. (1980) and Mongi *et al.* (1980) showed that intercropping methods effect on the grain and dry matter yields of maize, but cowpea yields decreased by intercropping cowpeas with maize. Girges. 1998 showed that yield and yield component of maize except shelling percentage were significantly affected by all intercropping treatment, in both seasons.

With respect to weed control, cropping patterns selected in management system can act to reduce weed densities and cause shifts in composition. density and spatial distribution of weed species in fields (O'Donovon. (1988), Liebman and Dyck. (1993), Altieri. (1995), Haikel *et al.* (1996), Tollenaar *et al.* (1996), Al-Marsafy and Hassanen (1997) and Bassal *et al.* (1998))

O'Donovon. (1988) found that population of wild oats increased in wheat/wheat rotation (>200 plants/m^2) by in the fourth year, whereas in canola/barley rotation population increased only by 40 plants/m^2 or less by in the fourth year. Haikel *et al.* (1996) found that dry weight of weeds associated with field beans cultivated after cotton markedly decreased as compared with that obtained from planting field bean after maize. Bassal *et al.* (1998) reported that fresh weight of weeds associated rice grown after berseem markedly decreased as compared with that obtained from planting after wheat.

Intercropping systems can also reduce number or weight of weed associated maize. Camel *et al.* (1983) reported that dry weight of annual (broad leaved and grasses) were significantly affected by intercropping systems in both seasons. Intercropping corn and soybean on the same ridges provide 24000 corn plants and 240.000 soybean plants/fedden, depressed weed growth in terms of dry weight at all samplings compared with alternate ridges of corn and soybean. Girges. (1998), found that the lowest weeds infestion were obtained by

intercropping system 100% maize with 100% soybean as compared with all other intercropping treatment and sole crop.

This investigation aimed to study the effect of preceding winter crops and cropping systems on yield, yield components and associated weeds of maize.

MATERIALS AND METHODS

Two experiments were carried out during the two growing seasons of 2002/2003 and 2003/2004 at Mallawi Agriculture Research Station (Middle Egypt) to study the effect of preceding winter crops and intercropping on yield, yield components and associated weeds of maize. A split-plot design with three replications was used. Preceding winter crops (wheat, fababean, berseem and onion) were allocated in the main plots while the cropping systems (Maize solid and Maize intercropped with cowpea) were arranged at random in sub plots. The sub plot area was 10.5 m^2 containing 5 ridges, each of 3.0 m in length and 70.0 cm. in width (1/400 fed). Planting and harvesting dates of wheat, fababean, berseem, onion, maize and cowpea are presented in table (1).

Calcium super phosphate (15.5 % P_2O_5) at a rate of 150 kg/fed was added during soil preparation. Nitrogen fertilizer was applied as ammonium nitrate 33.5% at rate of nitrogen was 120 kg/fed was applied in three equal doses just before the first, second and third irrigations of maize. The preceding winter crops were treated using normal cultural practices in the district.

Ten plants were chosen at random from each sub-plot to determine yield components of maize i.e. (number of ears/plant, number of rows/ear, number of kernels/row, weight of kernels/ear, weight of ear and shilling percentage). Yield of maize as well as, yield of cowpea were estimated from the whole sub plot area in kg/plot, then it was calculated /feddan.

Weed studies samples were hand pulled from one square meter for each sub plot before first and second hoening (hand hoening were done twice, 30 and 60 days after sowing).

Table (1): Planting and harvesting dates of wheat, fababean, berseem, onion, maize and cowpea in first and second season.

Crops	First seasons		Second seasons	
	Planting date	Harvesting date	Planting date	Harvesting date
Wheat (Giza 168)	16/11/2002	15/5/2003	18/11/2003	12/5/2004
Fababean (Giza 2)	20/10/2002	20/4/2003	22/10/2003	18/4/2004
Berseem (Giza 15)	20/10/2002	*	29/10/2003	*
Onion (Giza 6)	8/12/2002**	12/5/2003	6/12/2003**	17/5/2004
Maize (T.W.C 310)	6/6/2003	5/10/2003	10/6/2004	7/10/2004
Cowpea	21/6/2003	6/8/2003	25/6/2004	10/8/2004

* four cuts after 60, 105, 135, 170 days from sowing.

** Transplanted.

Data was subjected to statistical analysis according to Sendecor and Cochran (1980) and treatment means were compared by the least significant differences (L.S.D.) at 5% level of probability.

RESULTS AND DISCUSSION

A- Effect of preceding winter crops on maize and cowpea yields:

The data in table (2) indicated a significant effects of preceding winter crops (wheat, fababean, berseem and onion) on yield and yield components of maize except shilling percentage in the second season. Maize preceded by fababean was superior in all the studied characters followed by that grown after berseem. The lowest values were observed when it grown after wheat. These results hold true in both seasons. The superiority may be attributed to the high level of soil fertility which due to N fixation and decomposition after legume crops(fababean and berseem). These results are in agreement with those obtained by Touchton *et al.* (1992), Wagger. (1999) and Mac coll. (1991). Planting maize after fababean resulted in an increase estimated by 6.3 and 5.6% for number of ears/plant, 10.4 and 11.8 % for number of rows/ear, 18.22 and 18.50 % for number of kernels/row, 14.38 and 16.24 % for wet. of kernels/ear, 28.64 and 30.42 % for wet. of ear, 12.88 and 11.69% for shilling % and 19.09 and 17.33 % for grain yield /fed compared with those preceded by wheat in the first and second seasons, respectively. Similar results were reported by El-Hawary *et al.* (1994), Abou-Kresha. (1998) and El-Doby. (2002).

Data in table (2) showed that intercropped cowpea yield was significantly affected by the preceding crops in both seasons. The highest values (4.000 and 3.800 t/fed) were observed when preceding crop was berseem followed by fababean (3.73 and 3.60 t/fed). whereas, The lowest yield was obtained after onion and wheat (3.50 and 3.00 t/fed) and (3.40 and 3.20 t/fed) in the first and second seasons respectively. Similar results are obtained by Abou-Kresha *et al* (1998).

B. Effect of intercropping on yield and yield components of maize :

Data in table (3) show that cropping systems had a significantly effect on yield and yield components of maize except in case of number of rows/ear in second season and shilling percentage in both seasons. In general, the yield and yield components of maize were increased by intercropping with cowpea in both seasons. The increase in these characters were estimated 4.7 and 3.1 % for number of ears/plant, 6.38 and 3.79 % for number of rows/ear, 10.81 and 13.04 % for number of kernels/row, 3.89 and 6.25 % for weight of kernels/ear, 3.23 and 7.42 % for weight of ear, 0.17 and 3.54 % for shilling percentage and 3.74 and 5.05 % for grain yield/fed. as compared with solid maize in first and second seasons, respectively. These results could be attributed to the effect of cowpea as legume crop in enriching the soil with nitrogen and decomposition. Similar results were reported by Gunosena. (1980) and Mongi *et al.* (1980).

Table (2): Effect of preceding winter crops on yield and yield components of maize and intercropped cowpea yield during 2003 and 2004 seasons.

Characters / Preceding crops	No. of ears/ plant	No. of rows/ ear	No. of Kernels /row	Wet. of kernels/ ear (g)	Wet. of ear (g)	Shelling %	Grain yield/ fed (ardab)	Intercropped cowpea yield (T/fed)
2003								
Wheat	1.028	12.67	39.40	236.33	312.50	67.00	23.20	3.00
Fababean	1.093	14.00	46.58	270..33	402.00	75.63	27.63	3.73
Berseem	1.073	14.00	45.77	266.17	375.33	71.00	26.92	4.00
Onion	1.055	13.00	42.17	248.33	357.00	69.57	24.63	3.50
L.S.D at 5%	0.010	0.87	1.45	7.55	17.86	3.79	0.69	0.56
2004								
Wheat	1.030	12.67	39.17	226.00	295.33	68.43	23.25	3.20
Fababean	1.088	14.17	46.42	262.83	385.17	76.43	27.28	3.60
Berseem	1.070	13.83	45.75	258.00	369.00	64.97	26.75	3.80
Onion	1.053	13.00	41.50	241.83	351.67	67.77	24.08	3.40
L.S.D at 5%	0.015	0.79	1.57	4.33	7.69	N.S.	0.52	0.24

Table (3): Effect of intercropping on yield and yield components of maize during 2003 and 2004 seasons.

Characters / Treatments	No. of ears/ plant	No. of rows/ ear	No. of kernels/ row	Wet. of kernels/ ear (g)	Wet. of ear (g)	Shelling %	Grain yield/ fed (ardab)
2003							
Solid maize	1.038	13.00	41.25	250.42	355.08	70.74	25.13
Maize + cowpea	1.087	13.83	45.71	260.17	368.33	70.86	26.07
L.S.D at 5%	0.008	0.70	1.68	4.84	7.21	N.S.	0.56
2004							
Solid maize	1.044	13.17	40.54	239.67	337.75	68.19	24.72
Maize + cowpea	1.077	13.67	45.83	254.67	362.83	70.61	25.97
L.S.D at 5%	1.010	N.S.	1.06	3.88	5.40	N.S.	0.27

C. Effect of the interaction between preceding crops and cropping systems on yield and yield components of maize :

Data presented in table (4) showed in significant differences in studied characters of maize as affected by the interaction between preceding crops and cropping systems except in cases of number of kernels/row and weight of ear in second season. However, the highest values were observed when maize intercropped with cowpea and sequenced after fababean, followed by maize grown with cowpea and grown after berseem. The lowest values were observed when maize grown alone and grown after wheat. These results indicate that maize grown after fababean or berseem (legume crops) and intercropped with cowpea has a beneficial effect on yield and yield components. Similar results were obtained by Aly *et al.* (1993), El-Hawary *et al.* (1994) and Abou-Kresha. (1998).

Table (4): Effect of interaction between preceding crops and cropping systems on yield and yield components of maize during 2003 and 2004 seasons.

Preceding Crops	Characters / Cropping systems	2003						
		No.of ears/ plant	No.of rows/ ear	No. of kernels/ row	Wet.of kernels/ ear (g)	Wet. of ear(g)	Shelling %	Grain yield/ fed. (ardab)
Wheat	Solid maize	1.013	12.33	35.83	229.3	308.33	74.43	22.4
	Maize+ cowpea	1.043	13.00	42.97	243.3	316.67	76.83	24.0
Faba bean	Solid maize	1.063	13.33	45.50	265.6	394.00	67.43	27.2
	Maize+ cowpea	1.123	14.66	47.67	275.0	410.00	66.56	28.0
Berseem	Solid maize	1.043	13.66	44.50	261.6	364.00	71.90	26.6
	Maize+ cowpea	1.103	14.33	47.03	270.6	386.67	70.10	27.1
Onion	Solid maize	1.033	12.66	39.17	245.0	354.00	69.20	24.2
	Maize+ cowpea	1.077	13.33	45.17	251.6	360.00	69.93	25.0
L.S.D at 5%		N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
		2004						
Wheat	Solid maize	1.020	12.66	35.00	215.0	287.33	78.13	22.6
	Maize+ cowpea	1.040	12.66	43.17	237.0	303.33	74.73	23.8
Faba bean	Solid maize	1.063	13.66	45.00	255.6	364.33	66.70	26.7
	Maize+ cowpea	1.113	14.66	47.83	270.0	406.00	70.16	27.8
Berseem	Solid maize	1.057	13.66	44.50	251.0	352.67	58.76	26.1
	Maize+ cowpea	1.083	14.00	47.00	265.0	385.33	71.16	27.3
Onion	Solid maize	1.037	12.66	37.67	237.0	346.67	69.16	23.3
	Maize+ cowpea	1.070	13.33	45.33	246.6	356.67	66.36	24.8
L.S.D at 5%		N.S.	N.S.	2.11	N.S.	10.80	N.S.	N.S.

D. Effect of preceding crops and intercropping on weed:

Data in table (5) show the effect of preceding crops on fresh weight of weeds associated with maize. Significant difference in fresh weight of weeds due to crop sequence that cause unstable environments for weeds by varying patterns of resource, competition, allelopathic interference, soil disturbance, or mechanical damage appear to be the most successful for weed suppression (Altieri. 1995). These results are in agreement with that obtained by Sharoan and Immer. (1998), O'Donovon. (1988), Haikel *et al.* (1996) and Al-Marsafy and Hassanen. (1997).

Table (5): Effect of interaction between preceding crops and cropping systems on weeds in maize intercropped with cowpea during 2003 and 2004 seasons.

Preceding Crops	Seasons / Cropping systems	2003 Weeds fresh weight (kg/m^2)	2004 Weeds fresh weight (kg/m^2)
Wheat	Solid maize	2.77	2.74
	Maize + cowpea	1.81	1.74
	Mean	2.29	2.24
Fababean	Solid maize	2.49	2.58
	Maize + cowpea	1.71	1.64
	Mean	2.10	2.11
Berseem	Solid maize	2.31	2.32
	Maize + cowpea	1.61	1.61
	Mean	1.96	1.97
Onion	Solid maize	2.87	2.81
	Maize + cowpea	1.61	1.65
	Mean	2.24	2.23
Mean	**Solid maize**	**2.61**	**2.61**
	Maize + cowpea	**1.69**	**1.66**
L.S.D at 5% (Preceding crops)		0.13	0.07
L.S.D at 5% (Cropping systems)		0.09	0.07
L.S.D at 5% (PXC)		0.18	0.14

Concerning intercropping systems effect on weed fresh weight, it was observed that weed fresh weight was significantly affected by intercropping systems in both seasons. Weed weight when intercropping all maize ridges with cowpea was less than that grown without cowpea. These results clear that intercropping maize with cowpea on the same ridges decreased weed growth as compared with solid maize. The decrease in weight of weeds may be due to great competition between maize and / or cowpea plants and weed plants for light, water and nutrients. These results are similar to those obtained by Girgas. (1998) and Camel *et al.* (1983).

The interaction effect on weed weight/m^2, data in table (5) showed that weed weight/m^2 was significantly affected by the interaction between preceding crops and cropping systems in both seasons. The highest values of weed weight (2.77 and 2.74 Kg/m^2) were observed when maize was grown alone after wheat (first and second seasons, respectively). While the lowest values (1.61 and 1.61 Kg/m^2) was observed when maize intercropped with cowpea and sequenced by berseem in both seasons. These result were in agreement with those obtained by Liebman and DycK.(1993).

From the foregoing results, it could be concluded that the highest maize grain yield could be obtained when maize grow after fababean or berseem (legume crops) and intercropped with cowpea.

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تأثير المحصول السابق والتحميل علي المحصول ومكوناته والحشائش المصاحبه للذرة الشاميه

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أقيمت هذه الدراسة بمحطة البحوث الزراعيه بملوي لدراسة تأثير المحاصيل السابقه (القمح، الفول البلدي، البرسيم والبصل) والنظم الزراعيه (الذره المحمل بلوبيا العلف والذرة المنفرد) علي المحصول ومكوناته والحشائش المصاحبه للذرة الشاميه وكان التصميم المستخدم هو تصميم القطع المنشقه مره واحده في ثلاث مكررات.

ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي:

أثرت المحاصيل السابقه معنويا علي كل صفات محصول الذرة الشاميه تحت الدراسه خلال موسمي الزراعه ما عدا النسبه المئويه للصافي في الموسم الثاني، كما أظهرت النتائج أن زراعة الذرة الشاميه بعد الفول البلدي سجلت أعلي القيم للصفات ثم تلتها زراعة الذرة الشاميه بعد البرسيم في حين سجلت زراعه الذرة الشاميه بعد القمح أقل القيم لهذه الصفات خلال موسمي الزراعه. وإزداد محصول الذره الشاميه بعد الفول البلدي بمقدار ١٩,٠٩، ١٧,٣٣% في موسمي الزراعه الأول والثاني علي الترتيب مقارنة بمحصول الذرة الشاميه الناتج بعد القمح.

أوضحت النتائج أن أعلي القيم من محصول لوبيا العلف تم الحصول عليه عند زراعة لوبيا العلف تحميل مع الذرة الشاميه والمحصول السابق البرسيم (٤,٠، ٣,٨ طن/ف) بينما أقل القيم تم الحصول عليها عند زراعة لوبيا العلف مع الذرة الشاميه والمحصول السابق القمح (٣,٠، ٣,٢ طن/ف) في موسمي الزراعه.

كما أثرت المحاصيل السابقه علي وزن الحشائش المصاحبه للذرة الشاميه وكان الإنخفاض واضح عند زراعة الذرة الشاميه بعد البرسيم يليه الذرة الشاميه بعد الفول البلدي مقارنة بوزن الحشائش المصاحبه للذرة الشاميه عند زراعة الذرة الشاميه بعد القمح أو البصل.

* أظهرت النتائج زيادة المحصول ومكوناته عند تحميل لوبيا العلف مع الذرة الشاميه خلال موسمي الزراعه وكانت الزيادة في محصول الذرة الشاميه المحمل مع لوبيا العلف بمقدار ٣,٧٤ ، ٥,٠٥% في موسمي الزراعه الأول والثاني علي الترتيب مقارنة بمحصول الذرة الشاميه المنفرد.

كما أظهرت النتائج أن أعلي وزن للحشائش كان ٢,٩٧، ٢,٧٤ كجم/م٢ عند زراعة الذرة الشاميه منفرد والمحصول السابق هو القمح بينما كان أقل وزن ١,٦١ كجم/م٢ عند زراعة الذرة الشاميه محملا بلوبيا العلف والمحصول السابق هو البرسيم خلال موسمي الزراعه علي الترتيب.

نستنتج من النتائج السابقه أن زراعة الذرة الشاميه بعد محصول بقولي (الفول البلدي أو البرسيم) بجانب تحميل لوبيا العلف على خطوط الذره الشاميه أعطى أفضل محصول للذرة الشاميه مع إنخفاض نسبة الحشائش الناميه.