J. Plant Production, Mansoura Univ., Vol. 4 (2): 123 - 132, 2013

EFFECT OF IRRIGATION INTERVALS AND DISTRIBUTION OF MAIZE ON YIELD AND COMPONENTS OF RICE/MAIZE INTERCROPPING.

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ABSTRACT

Two field experiments were conducted during 2011 and 2012 summer seasons at Gemmeza Research Station,El Gharbia Governorate,Egypt,to study the influence of irrigation intervals and distribution of maize plants on yield and its components of imaize and rice intercropped.The experiments were coducted in strip splot design,with three replicates,where irrigation intervals were every 6 days (I1),every 10 days(I2) and every 14 days(I3) occupied the vertical plots (strip) and distribution of maize plants (one plant with 20cm between hils,two plants in hill with40cm between hills and three plants in hill with 60cm between hill) were assigned to the horizontal plots.

Results were summarized as follows;

1- All the traits of rice were significantly affected by irrigation intervals in both seasons,except, unfilled grains % in the second seasons.I1 followed by I2 treatments gave the highest values between all the characters of rice in both seasons,however, I3 treatment recorded the lowest values ,except, unfilled grains%.

2-All characters of maize were significantly affected by irrigation intervals in both seasons,except, ear height,stem diameter, number of leaves/plant and ear leaf erea in the two seasons and weight of grains/ear in the first seasons.However,all characters for maize had insignificant by distribution of plant of maize in both seasons,except,100-grain weight and grain yield/fed in the second season and plant height, ear length and weight of grains/ear in the two seasons.

3- The interaction between irrigation and distribution of maize plant had insignificant effect on all the traits of rice and maize ,except, weight of grains/ear and 100-grain weight for maize in the first seasons.

4-The highest values of Land equivalent ratio(LER)were 1.298 and1.293 in the two seasons,respectively,with irrigation intervals I1 and I2,respectively.

5-Relative crowding coefficient (RCC)was 4.21 and4.75 in the two seasons were recorded with irrigation intervals I1 and I2 ,respectively.

6-Aggressivity(Ag) indicated that rice was the dominat crop ,whereas, maize was the dominated in both seasons.

7-The highest gross return was obtained with(I1)

Generally , it could be concluded that irrigation every 6 days and planting maize with three plants/hill with distance 60 cm between the hills could be used to obtained high grain yield for rice and irrigation every 14 days and3 plant /hill of maize at distance 60 cm for maize.

INTRODUCTION

Rice(oryza sativa L)is a major food crop and a cereal grain in Egypt, that is adapted to flooding conditions. About one-half of the world population lives on it. In Egypt, rice is grown under flooding condition and is consider a water-consuming crop. it is a heavy consumes of freshwater, and approximately 25% of water requirements used in Egyptian in agriculture goes to rice production (Ainer *et al*.,1999).Irrigation water is relatively limited and insufficient for both reclamation and irrigation purposes for Egyptian soil. So, many tedious trails were done to maximize rice productivity and rationalize water use

Nour *et al*. (1994) found that increasing irrigation interval for broadcasted-seeded rice longer than six days significantly decreased plant height, biomass production, rice grain yield and its components. They, also, found that water requirement for land prepraration and thirty days before starting irrigation treatments was 6350 m^3/ha.While,the total amounts of water used were 15450,13350 and11950m^3/ha. For irrigation every6,9 and12 days respectively and there were differences among rice cultivars in consumed water. Awad(2001 found that grain yield was not affected by irrigation intervals, raning from four to eight days. Marazi *et al*.(1993) and Sorour *et al*.(1998) found that grain yield of rice was significantly affected by irrigation regimes. However, Mahrous and Ali(1986), Nour(1989) found that grain yield tended to insignificantly decrease at eight days irrigation intervals.

Rice production could be increased through (1) intensification,(2) extensification and(3) cropping systems improvement programs (Prajitno,1992.Intercropping is one of the forms of cropping patterns in cropping systems program, i.e. growing two or more crops simultaneously on the same field, in the same time, usually planted in rows side by side(Prjitno,1987).Consequently there is an interaction between crops grown in this system. The crops should be chosen so they can get the advantages on using time and space efficiently and able to press down the competition effect to minimum.

Maize is one of the most important food and feed crops in Egypt for human consumption and animal feeding.Intercropping system is especially beneficial for small farmers is the low-input high risky environment of the developing areas of the world.It is perhaps the best example of how interactions between crops can be exploited to produce considerable yield benefits.Intercropping can achieve much larger yield than sole crops by using environmental resources more fully over time or more efficiently in space(Willy *et al*.,1972).

The objectives of this study were to determine the effect of irrigation intervals under intercropping systems and their interaction on yield and its components of rice and maize crops and the best intercropping system for maximizing the net profit per unite area.

MATERIALS AND METHODS

Two field experiments were conducted at the Farm of EL-Gemmiza Agriculture Research Station, Agriculture Research Center, Egypt, during 2011 and 2012 summer seasons to study the effect of irrigation intervals and three intercropping patterns on the productivity of maize (three way cross 173) and rice (Giza 178).

The experiments were carried out in a strip plot design with three replicates.

The vertical plots consisted of three different irrigation intervals:

(1) Irrigation every 6 days(I1).

(2) Irrigation every 10 days(I2).

(3) Irrigation every 14 days(I3).

The horizontal plots were randomly assigned by three distribution of maize plants :-

(1) - One plant /hill,20cm apart(D1).

(2) -Two plants/hill,40cm apart(D2).

(3) -Three plants/hill,60cm apart(D3).

All the previous patterns resulted 17500 maize plants. The preceding crop was berseem in the two seasnos.

Siol at the experimental site had the following chemical analysis of PH-8.1,total organic matter-1.3% available N=37 ppm, available P=12 ppm and available k=580ppm.

The plot area was 33.75 m2 containing 5 ridges each of 5.0m length , 60 cm width and 75 cm between the ridges. Pre-germinated seeds for rice were broadcast in the nursery on 16 and 19 May in 2011 and 2012 seasons, respectively with the rate of 30kg /fed.Three to four seedlings,28-days old, were transplanted at 15x15 cm distance between hills and rows.

Intercropping systems were rice + maize, rice were transplanted between the ridgs, while maize were intercropped up the ridgs on the same day at the two seasons. Besides the intercropping crops, rice and maize were planted as a sole crop. Nitrogen(N) in form of urea(46.5%.N),Phosphorus in form of (superphosphate 15%P_2O_5),Potassium in form of (potassium salifat 50%(K_2O))and Zinc sulfate ($ZnSO_4$)as well as all other routine cultural practices until harvest of rice and maize crops were followed as recommended.

At harvest the studied characters for rice were recorded as follows: plant height was counted from ten random hills. Ten random main panicles were collected from each plot to estimate panical length, number of grains/panicle, unfilled grain percentage, panical grains weight and 1000-grain weight. Grain and straw yields were measured from an area of 24 m2 in the center of each plot.Grain yield was adjusted to 14% moisture content.

The studied characters for maize were recorded as follows: plant height (cm), ear height(cm),ear leaf erea(cm^2),stem diameter(cm)(data were recorded as average of 10 guarded plants from each plot),ear character; ear lenth and diameter ,number of rows/ear,100-grain weight and grain yield of maize/fed. was determined from the plot.

Competitive Relationships and yield Advantages

-Land equivalent ratio(LER):according to Willy and Osiru(1972),Relative crowding coefficient(K) according to De Wit (1960),Aggressivity(A): according to Mc Gillchrist(1965).

Gross return

Gross return from each treatment was calculated in Egyptian pounds(LE)at prices of LE1837/ t for (grain) and LE108 (straw yield) for rice and LE260/ ardab for maize.(Agricultural Statisties(2010),Economic Affairs Sector)

Data were statistically analyzed strip plot according to the procedures outlind by Gomez and Gomes(1984)and LSD test was used to compared between treatment means.

RESULTS AND DISCUSSION

Effect of irrigation intervals and intercropping maize on rice field grain yield and attributes of rice

Grain yield and most attributes were significantly affected by irrigation intervals in both seasons (Table 1). Irrigation every fourteen days decreased plant height, number of branches per panicle, number of filled grains per panicle, panicle grain weight, 1000-grain weight, panicle length, straw yield and grain yield (t/fed) in both seasons. On the other hand, unfilled grain percentage was increased with increasing irrigation intervals up to every fourteen days.

The highest values of most attributes were obtained byI1, followed by I2, while the lowest values were obtained from I3, which also, produced the highest values of unfilled grain percentage. Grain yields were 3.534, 3.168and 3.059 t/fed in 2011 seasons, while they were 3.745, 3.472 and 3.152 t/fed in 2012 season for I1, I2 and I3 irrigation treatment, respectively. The reduction in grain yield, as affected by prolonging drying period might be attributed to the decrease in grain yield components. Similar finding were reported by Phogat and Pandey (1998), Awad (2001)and El-Refaee *et al*. (2007).

Data presented in Table 1 showed that rice traits were significantly affected by the distribution of maize plants in both seasons, except number of filled grains/panicle, unfilled grain percentage,panical grains weight and plant height in the second season only. All characters were increased (doubling distance between hills of maize plants increase from 20,40 to 60 cm. by increasing distribution of maize except unfilled grain percentage which was decreased by them to. These results may be due to planting maize at three plants /hill (60 cm between hills) with rice reduce the competition among rice and maize plants for environmental resources (light, water and nutrients).

The results in Table 5 showed that, plant height was significantly affected by the interactions between irrigation intervals and distribution of maize only in the first seasons such plant height recorded its maximum value (84.07 cm) of D3 when irrigation with I1 treatment (60 cm between hill and irrigation every 6 days). However the lowest value was given by D1 with I3 treatments(67.3).

Effect of irrigation intervals and intercropping maize and rice on maize field

The results in Table 2 indicated that plant height, ear length, 100-grain weight, weight of grains/ear, no. of grains /ear and grains yield/fed, were significantly increased by increasing period for irrigation treatments (I) as compared with pure stand in both seasons. The highest values of most attributes were obtained by (I_3), followed by I_2, while the lowest values were obtained from (I_1). Grain yield were 8.9, 10.03 and 10.93 (ardab/fed) in 2011 season, while they were 7.71, 9.29 and 10.4 ardab/fed in 2012 season for I_1, I_2 and I_3 irrigation treatments, respectively.

Intercropping maize with rice and distribution of maize significantly affected on plant height, ear length and weight of grains /ear in both seasons and weight of grains yield/fed. in the first season only. They were increased by doubling distance between hills and maize plants from 20, 40 to 60 cm and increasing number of plants per hill from one, two to three wide distance between hills of maize plants increased grain yield per feddan by 10.6% and 8.3% in the first and second seasons, respectively, as compared with the narrow one, this may be attributed to the maize plants grown at 60 cm were more efficient in utilizing solar energy and consequently the dry matter content per unit area was greater with distributing plants in wide distance (Metwally *et al*. 2009). These results are in agreement with those obtained by El-Douby (1987), Metally *et al*. (2003) they found that grain yield of maize plant was increased by increasing the distance between hills.

All the studied characters of maize plants were not affected significantly by the interactions among irrigation (I) and distribution of maize plants, except weight of grains per ear (g) in the first season, only. The data in Table (6) showed that irrigation after 14 days (I3), as well growing intercropped maize plants in wide distance at 3 plants/hill at 60 cm between hills (d3) gave the height intercropped maize yield per ear (147.43 g) .

Competitive relationships and yield advantage

Land equivalent ration(LER)

Data in Table 3 reveald that interaction maize with rice increased land equivalent ratio(LER)in all irrigation tretments in the two seasons .Irrigation after 10 days gave the highest values for (LER)were1.298and1.293 in the first and second seasons, respectively. While, irrigation after 14days produced the lowest values of(LER)were1.273and1.266 in both seasons, respectively. In all irrigation treatments rice were more contributing than maize in both seasons .

Crowding Coefficient(RCC): Relative

Data in Table3 showed that the highest values of (RCC) were(4.21and4.75)in both seasons ,respectively, were obtained from irrigation after6days and after10days in the first and second seasons, respectively. While the lowest values of (RCC) were (3.24and2.90) in the two seasons, respectively.

Aggressivety(A):

Data presented in Table3 revealed that aggrectivety was affected by irrigation treatments and intercropping maize and rice in both seasons. Aggressivety values of rice were positive (dominated crop)in both seasons, whereas, aggressivety values for maize was negative(dominant crop)in both seasons, respectively

1,2

3,4

Table 5: Effect of the interaction between irrigation intervals and distribution of maize plants on plant height of rice plant.

Treatment	Plant height(cm)		
	2011		
	D1	D2	D3
I1	82.3	78.2	84.07
12	73.07	72.13	77.03
13	67.3	67.7	72.4
LSD at 0.05	2.5		

Table 6:Effect of the interaction between irrigation intervals and distribution of maize plants on weight of grains/ear .

Treatment	Weight of grains/ear(g)		
	2011		
	D1	D2	D3
I1	127.89	124.5	122.82
12	131.13	127.89	126.19
13	132.3	135.15	147.43
LSD at 0.05	0.49		

Economic Evalution

Gross Return

The highest total income were(L.E.9261.3 and 9427.8)in the first and second seasons ,respectively,was obtained with irrigation every 6 days(Table 4).

REFERENCES

Agricultural Statistics(2010).Economic Affairs Sector,Ministry of Agriculture,Egypt,(in Arabic).

Ainer,N.G.;W.I.Miseha;F.A.Abbas andH.M.Eid (1999).Anew cocept of rationalization of irrigation water use in Egypt.Third conf. of on-farm Irrigation and Agro .climatology,2:721-755.

Awad,H.A.(2001).Rice production at the North of Delta in Egypt as affected by irrigation intervals and nitrogen fertilizer levels.J.Agric.Sci.Mansoura Univ.,26:1151-1159.

De-Wit,C.T.(1960):Intercropping its important an research needs.Part1.competition and yield advantages.Verslay Langbov Wkundige onderzoek No.66:1-28LC(C.F.field crop Abst,32,1-10).

El-Douby ,K.A.((1987).Growth and yield of maize as affected by plant density and distribution.M.Sc.Thesis.Fac.Agric.Moshtohor,Zagazic,Univ.,Egypt.

El-Refaee, I. S.; A. E.Abd El-Wahab ; F. N. Mahrous and S.A.Ghanem(2007).Irrigation management and splitting of nitrogen application as affecting on grain yield and water productivily of hybrid and inbred rice.African crop science conference,El-Minia Univ.,October,27-31(8):45-52.

Gomez,K.A. and A.A.Gomez(1984).Statistical procedures for Agricultural Researches.2th Ed.,John Wily&Sons.U.S.A.

Mahrous,F.N.and A.E.Aly(1986).Water management in rice.3rd Nat.Conf., Rice Tech. Training Center,Alex.Egypt.

Marazi,A.R.;G.M.Khan;K.N.Sing andA.S.Bali(1993).Response of rice (Oryza sativa L.)to different nitrogen levels and water regimes in Kashmir Valley. Indian J. Agric. Sci.36(11):726-727.

MC.Gillchrist,C.A.(1965):Analysis of competition experiments .Biometrics ,21:975-985.

Metwally,A.A.; G.O.Mohamed; M.N.Shereif and D.R.E.Abo Hegazy(2009).Yield and Land equivalent ratio of intercropped corn and soybean under three intercropping patterns.4th Conference on Recent Technologies in Agric.,2009.

Metwally,A.A.;EL.A.EL Metwally;M.M.Shafik and S.A.Safina(2003).Tolerance of some corn varities to intercropping.The 10th Conf. Egyptian Soc. EL Arich,Egypt,279-293.

Nour,M.A.;A.E.Abd EL-Wahab and S.A.Ghanem(1994).Broadcast-seeded rice as affected by different irrigation intervals.Egypt. J.Appl.Sci.,9(8):671-683.

Nour,M.A.(1989).Studies on fertilization and irrigation on rice. Ph. D.Thesis,Fac. of Agric. Kafr El-Sheikh,Tanta Univ., Egypt.

Phogat,B.S. andJ.Pandey(1998).Effect of water regimes and weed control on flora and yield of transplanted rice(Oryza sativa L.).Indian J.of Agron. 43(1):77:81.

Prajiton,D.(1987).Advantage and disadvantage of intercropping system.A system approach.Proc. 3rd National Sept.25,1986.pp.25-41.(in Indonesian).

Prajitno,D.(1992).Optimization of Cropping systems in progo River Basin Area.Dissertation(Dr. in Agric. Sci.).GadjahMada Univ.Yogya Karta.pp.431(un published).(C.F.computer search).

Sorour,F.A.;M.E.Mosalem;F.N.Mahrous and I.S.EL-Refaee (1998).Effect of irrigation intervals and splitting of nitrogen on growth,yield and quality of rice.J.Agric.Res. Tanta Univ.(1):60-75 .

Willy,R.W. and S.O. Osiru(1972).Studies on mixture of maize and beans(Phaseolus vulgaris) with particular reference to plant population. J.Sci. Cambridge 79:519-529.

دراسة تأثير فترات الرى والتوزيع النباتى للذرة على المحصول ومكوناته لكل من الأرز والذرة المحملين

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أقيمت تجربتان حقليتان بالمزرعة البحثية بمحطة بحوث الجميزة – محافظة الغربية خلال موسمى ٢٠١١ و ٢٠١٢م لدراسة تأثير فترات الرى (الرى كل ٦ ايام، الرى كل ١٠ ايام،ا الرى كل ١٤ يوم) وثلاث كثافات للذرة المحمل على الأرز (١ نبات فى الجورة على مسافة ٢٠ سم بين الجور ، ٢ نبات فى الجورة على مسافة ٤٠ سم بين الجور ، ٣ نبات فى الجورة على مسافة ٦٠ سم بين الجور) ونفذت التجربة فى نظام الشرائحى المتعامدى فى ثلاث مكررات.

وأظهرت النتائج:-

١. جميع الصفات تحت الدراسة لمحصول الأرز تأثرت معنويا لفترات الرى فى كلا الموسمين حيث وجد أن نظام الرى كل ٦ يوم أعطى أعلى إنتاجية لمحصول الحبوب/ف وإرتفاع النبات ووزن ١٠٠ حبة فى كلا الموسمين بينما أعطى أقل قيمة لنسبة الحبوب الفارغة مع زراعة الذرة فى جور على ٦٠ سم وترك ٣ نبات فى الجورة
٢. جميع الصفات تحت الدراسة للذرة تأثرت معنويا بفترات الرى فى كلا الموسمين ولم تتأثر معظم الصفات بالتوزيع النباتى للذرة مثل إرتفاع النبات وطول الكوز ووزن الحبوب/كوز ومحصول الحبوب/ف فى الموسم الثانى.
٣. التفاعل بين فترات الرى والتوزيع النباتى للذرة لم يكن معنويا على جميع صفات الأرز تحت الدراسة
٤. أعلى قيمة لمعدل إستغلال الأرض جاءت (١,٢٩٨ و ١,٢٩٣) فى الموسم الأول والثانى مع فترات الرى كل٦ايام ثم كل ١٠ ايام على الترتيب.
٥. أعلى عائد مادى تم الحصول عليه من المعاملة الاولى للرى(رى كل ٦ يوم)وكانت ٩٢٦١.٣ و ٩٤٢٧.٨١ جنيها فى الموسم الاول والثانى على الترتيب.
٦. بصفة عامة يمكن التوصية بالرى على فترات كل ٦ أيام مع التوزيع النباتى للذرة (٦٠ سم بين الجور مع ترك ٣ نبات فى الجورة)للحصول على افضل عائد مادى.

قام بتحكيم البحث

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Table 1 :Effect of irrigation intervals (I),distribution of maiz(D)and interaction on yield and components of rice in the two seasons of 2011and 2012 .

characters / Treatments	Plant height(cm)		Panical length(cm)		NO.of branches/ panical		NO.of filled grains/ panicale		Unfilled grains//%		Panical grains weight(g)		1000-grain weight(g)		Straw yield (t//fed)		Grain yield (t/fed)	
Irrigation intervals	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
I!	86.88	81.70	19.83	21.06	8.38	8.71	96.3	97.3	5.49	5.02	2.674	2.553	21.99	22.65	4.950	5.033	3.534	3.745
I2	70.74	74.2	18.34	19.86	7.89	7.93	88.67	93.63	5.69	5.28	2.041	1.929	21.03	20.42	4.441	4.351	3.168	3.472
I3	61.38	69.04	17.67	18.57	7.53	7.87	77.35	79.38	6.14	6.24	1.837	1.786	20.7	20.43	4.258	3.942	3.059	3.152
Solid															5.025	5.063	4.304	4.438
LSDat0.05	2.24	13.8	NS	1.58	.43	.62	9.19	15.4	.05	NS	.87	.56	. 3	2.78	1.86	1.24	.28	NS
Distribution of maize(D)																		
D1	68.18	78.74	17.16	18.89	7.57	7.79	82.13	79.4	6.14	5.84	1.881	1.792	20.21	20.29	4.211	4.117	2.913	3.075
D2	74.53	82	19.01	19.78	7.99	8.15	87.61	87.92	5.80	5.44	2.215	2.157	21.27	20.98	4.988	4.429	3.238	3.517
D3	76.29	77.36	19.68	20.81	8.25	8.58	92.41	89.90	5.44	5.26	2.457	2.431	22.25	22.67	4.815	4.770	3.652	3.779
LSD at0.05	3.5	NS	NS	1.38	.22	.34	6.22	NS	.34	NS	.49	NS	.97	1.69	.84	.49	.37	.43
IXD	*	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2:Effect of irrigation intervals(I), distribution of maize(D) and interaction on yield and components of maize in 2011 and2012 seasons.

Characters / Treatments	Plant height(cm)		Ear height(cm)		Stem diameter (cm)		Ear length(cm)		NO.of leaves/plant		Ear leaf erea(cm2)		Weight of grains/ear (g)		100-grain weight (g)		NO. ofgrains/ear		Grain yield/fed (ardab)	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Irrigation intervals																				
I1	234.9	261.8	106.69	102.36	2.11	2.64	18.9	19.38	11.49	11.31	517.1	503.46	125.07	134.69	30.35	30.62	435.8	405	8.9	7.71
I2	252.8	270.8	105.68	106.72	2.62	2.91	20.66	20.34	11.62	11.51	569.06	547.22	128.4	143.07	32.08	31.91	439.03	483.9	10.03	9.29
I3	262.3	280.6	107	114.27	3.18	3.09	22.23	22.76	12.28	12.16	437.3	560.53	138.96	149.91	33.05	35.2	428.4	524.3	10.93	10.4
Solid																			18.63	17.95
LSD at0.05	15.5	13.47	NS	NS	NS	NS	1.31	1.07	NS	NS	NS	NS	NS	3.04	1.56	3.28	48.8	89.21	1.08	2.7
Distribution of maize(D)																				
D1	238.4	256.9	98.56	103.31	2.36	2.69	19.1	19.21	11.62	11.56	490.3	534.41	127.1	139.82	31.6	32.18	450.4	480.9	9.4	8.76
D2	246.2	272.8	107.56	108.11	2.76	2.82	20.81	20.91	11.74	11.64	480.61	533.16	129.18	142.94	31.84	32.65	453.7	476.9	9.95	9.08
D3	265.3	283.4	113.27	111.93	2.8	3.13	21.78	22.36	12.13	11.78	552.51	543.63	139.82	144.99	32.03	32.89	453.1	456.6	1052	9.56
LSD at 0.05	15.74	8.47	NS	NS	NS	NS	1.61	.97	NS	NS	NS	NS	.84	3.04	5.91	NS	NS	NS	.34	NS
IXD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	*	NS	NS	NS	NS	NS	NS	NS

Table 3 :Competitive relationships calculated from yields as affected by intercropping rice with maize by irrigation treatments.

Treatments	LER(rice)		LER(maize)		LER		Ka(rice)		Kb(maize)		K(RCC)		Aab(rice)		Aba(maize)	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
I1	0.823	0.836	0.475	0.430	1.298	1.266	2.29	2.51	1.84	1.53	4.21	3.84	0.348	0.407	-0.348	-0.407
I2	0.737	0.775	0.536	0.518	1.273	1.293	1.38	1.7	2.34	2.18	3.24	4.75	0.201	0.258	-0.201	-0.258
I3	0.712	0.704	0.584	0.579	1.296	1.283	1.22	1.2	2.85	2.48	3.47	2.90	0.128	0.124	-0.128	-0.124
D1	0.670	0.687	0.502	0.488	1.172	1.175	1	1.24	2.05	1.94	2.05	2.4	0.168	0.199	-0.168	-0.199
D2	0.754	0.785	0.531	0.506	1.285	1.291	1.51	2.22	2.90	1.55	3.47	3.44	0.223	0.279	-0.223	-0.279
D3	0.848	0.844	0.562	0.533	1.410	1.377	2.8	2.66	2.60	2.19	7.3	5.84	0.286	0.312	-0.286	-0.312

Table 4:Total income of rice and maize advantages of Irrigation in 2011/2012 seasons.

	Solid rice(t/fed)		Solid maize(ardab)		Rice	I1	Maize	Rice	I2	Maize	Rice	I3	Maize	
	Grain yield	Straw yield	Grain yield		Grain yield	Straw yield	Grain yield	Grain yield	Straw yield	Grain yield	Grain yield	Straw yield	Grain yield	
2011														
Yield	4.29	5.03	18.63		3.21	4.95	8.9	3.168	4.440	10.3	3.06	4.25	10.93	
Actual yield L.E.	7880.84	543.25	4843.8		6490.7	534.6	2236	5818.69	479.61	2678	5619.69	459.9	2841.8	
Total incomeL.E.		13267.89				9261.3			8976.3			8921.39		
2012														
Yield	4.48	5.06	17.59		3.75	5.03	7.71	3.471	4.35	9.29	3.151	3.94	10.4	
Actual yield L.E.	8228.2	546.75	4573.4		6879.6	543.6	2004.6	6377.50	469.89	2415.4	5789.61	425.7	2704	
Total incomeL.E.		13348.35				9427.8			9262.79			8919.31		