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The effect of intercropping (corn and soybean) on vigor of seed corn

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ABSTRACT

In order to investigate the effect of intercropping on vigor of seed corn an experiment was conducted in complete randomized block design with four replications in the research labs of Gorgon University of Agricultural Sciences and Natural Resources. The treatment were including : four planting dates (May 4,May 19,June 4,June 19) and 3 planting rates (pure corn, 50 percent corn + 50 percent soybean and pure soybean).The characters including emergence percentage, electrical conductivity, dry weight, dry weight in cold test, germination speed, primary germination rate, growth speed and growth in cold test. The results showed with the delaying planting date in intercropping system was decreased all the characters (except electrical conductivity).

Key words: Intercropping, Vigor seed, Corn and Soybean.

INTRODUCTION

Increasing yield production depends on seed with high vigor and germination. High seed quality is necessary to establish crops, therefore cultivated seed should have high vigor and related physiological characters. These traits have important role in undesirable cultivation conditions. The traits such as seed situation on the plant, cultivation date, drought stress, temperature, irrigation period, nutrition uptake, and plant density can effect on seed quality [9]. Jahandide [5] revealed that planting date did not effect on rate and seed uniformity of chickpea but germination was effected by planting date. Roozrokh et al [11] explained that there is significant correlation between seed yield and electric conductivity and germination rate in chickpea varieties. Latifi et al [6] expressed that late sowing date increase seed decaying. Soltani et al [13, 14] declared that seed with high vigor, increase, early germination and finally plant growing. Opko and gamil [10] explained that germination test in cold conditions help to predict and evaluation seed vigor in cold climate. Relationship between different traits and seed germination were reported by many scientists [1,3,4,8].Because of biological advantage of intercropping this experiment was carried out to find out the effect of Maize and Soybean intercropping on seed vigor of maize.

MATERIALS AND METHODS

To study the effect of Maize and Soybean intercropping, this experiment was set up based on randomized complete block design (RCBD) with four replications at Agricultural and Natural Resources of Gorgan university. At first, seed dormancy, 1000 grain weight, hectoliter weight and seed humidity were measured. For evaluation of seed vigor, the seedling growth rate, electric conductivity and cold test were done based on ISTA protocol.

Seed germination test
On each Petri dish, 50 maize seeds were placed, at 25°c germinate. First counting was done on 4th germination day and second counting was done on 7th germination day. The normal seedling, abnormal seedling, hard seed, in germinated seed and in viable seed were identified.

Growth rate test
On each Petri dishes 25 maize seeds were put on the germination papers including 30 cm^3 water at 10°c for 24 hours to reach balance conditions. After that, peltries were placed in incubator at 25°c , then after seven days normal seedling and in viable seed were counted. From normal seedling, root and stem were cut and put them at 80°c for 24 hours, then dry weight of root and shoot were measured.

Electric conductivity (EC)
Determination of EC is a criterion to work out seed vigor based on seed membrane homogeneity. EC was calculated by EC meter (HANNA-HI8633) instrument.

Cold test
In cold test, artificial conditions similar to normal situations were prepared to grow plants. In this method the amount of organic materials should not be high. The field soil was passed through the 5mm sieve and then, was mixed with one part of field soil and two parts of sand or vermiculate. The seed moisture must be 13-14 percent. Wet papers were kept at 10 ºc for 12 hours. After that the seeds were covered by light amount of mixed soil and sand, then put in the incubator at 10 ºc for 7 days and then were transferred plant materials into the 25 ºc incubator for 5 days. Finally the normal plants, abnormal seedlings, germinated seeds, in germinated seeds, dead and hard seeds were counted. Then, they the biomass of normal seedlings was weighted.

Germination rate
Germination rate was calculated [1](AOSA[1], 1983) by the following formula:

$$R= \Sigma n/\Sigma D.n$$

n= number of germinated seeds in D days.
D=number of experiment days.
data analysis was done by SAS and Excel soft wares.

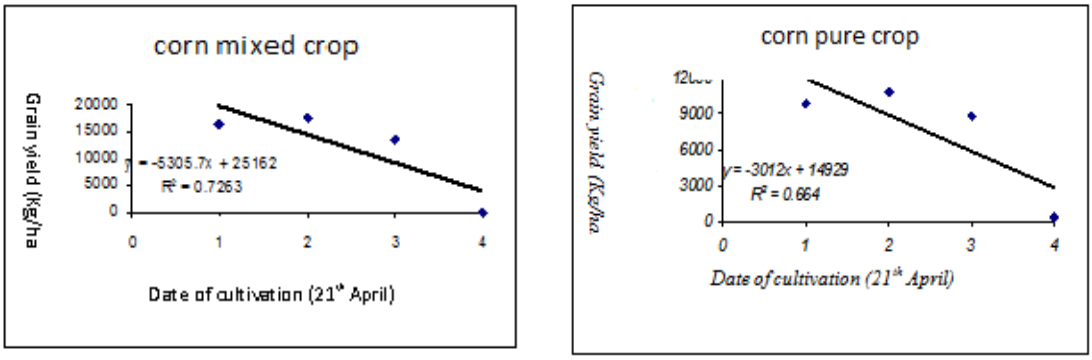

Fig.1 Relation between planting date and yield in intercropping system and pure cropping.

RESULTS AND DISCUSSION

The result of analysis of variance was shown in table1. There is significant differences for planting rate, planting date and planting rate * planting date. Fig.1 showed that there is negative linear relationship between yield and

[1] . Analysis of Seed Association

planting date for both planting system (intercropping and pure planting). There is high relationship between yield and planting date in intercropping system. In pure planting the yield was decreased by late planting system significantly. These results would be due to decrease nitrogen fixation by soil micro organisms. Mazaheri [8] reported similar results.

Table 1- Analysis of variance of different traits

Source of variation	Degree of freedom	Standard germination	Electrical conductivity	Biomass (cold test)	Biomass (test of seedling growth rate)	Germination rate	Primary germination	Growth rate	Growth rate (cold test)	Grain yield
Replication	3	0.75	0.00037	0.00041	0.0005	0.0006	1.11	0.004	0.00002	3037.94
Ratio of cultivation	1	128**	1.05**	0.001**	4.47**	0.01**	0.47**	0.001**	0.00001**	162653157.03**
Planting date	3	2922.25**	19.37**	4.21**	27.43**	141.82**	2239.40**	0.002**	0.00001**	328936460.53**
Ratio of cultivation* Date of cultivation	3	7.41**	0.61**	0.01**	0.62**	0.09**	13.76**	0.002**	0.00001**	21684173.03**
Error	21	0.96	0.000033	0.000045	0.00001	0.000003	0.24	0.005	0.0001	1950.18
Total	31	8939.51	61	12.69	91.66	428.36	6768.39	0.00004	0.000001	1214565125.46
Coefficient	____	1.19	0.16	0.29	0.07	0.02	1.62	0.000003	0.000003	0.45

Germination percent

Fig.2 illustrates that germination was decreased linearly in both cropping system with planting date. The reason of this situation is due to decrease of seed health. There was no significant correlation between planting date and percentage germination in both cropping systems.

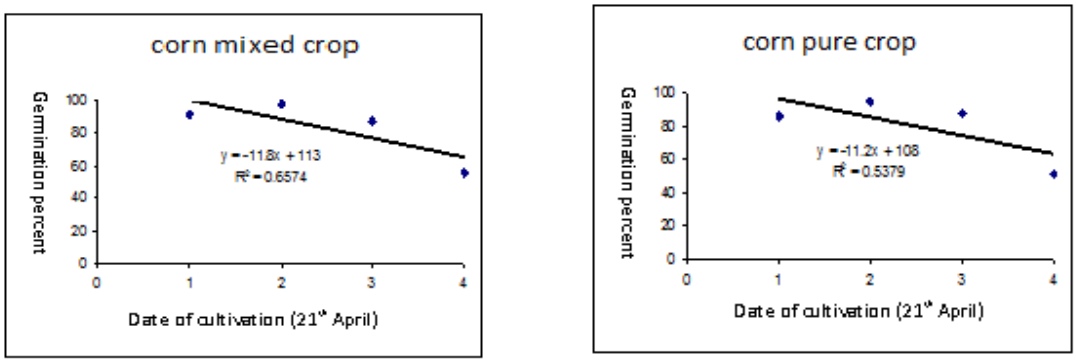

Fig.2 relation between planting date and corn germination percent in pure and mixed crop systems

Electrical conductivity

In both cropping systems planting date causes decreasing of EC, because of low germination and less seed viability in unfavorable environmental conditions. Planting increase the amount of EC in both intercropping and mono cropping(0/95 and 1/3 D.zimens/ m^2/ day consequently). Opouk and Gamble [10] showed that the high frazzle increases the membrane damage, disturbance of enzyme activity and other cell structures.

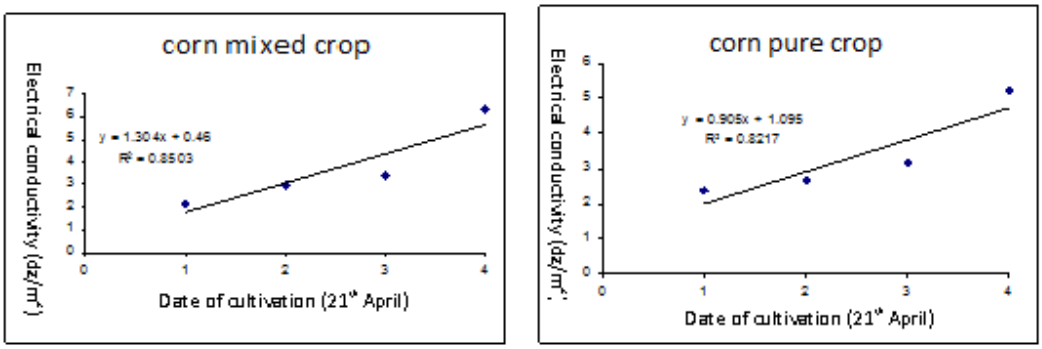

Fig.3 relation between date of cultivation and electrical conductivity amount in pure and mixed crop systems

Seedling growth

Late planting decreased dry yield in both intercropping and mono culture (0.86 and 1.2 mg/d) consequently. Unfavorable environmental conditions in late planting cause in viable seed and finally weak seedling formation. Latifi and et al [7] reported that weak seedling can not absorbed light and yield reduced. Golozani and et al [4] explained similar results as would be well.

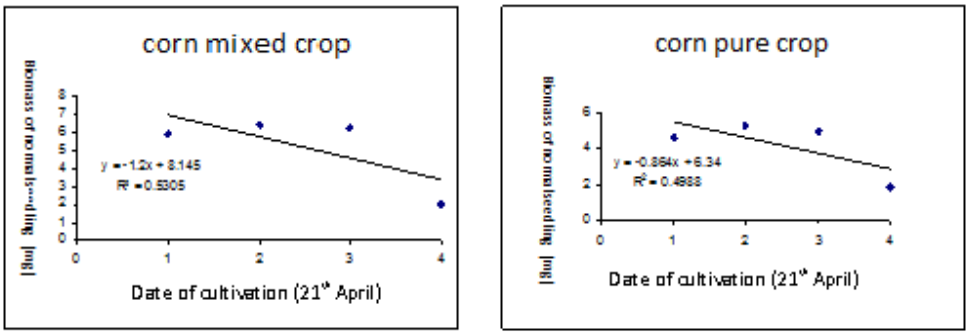

Fig.4 relation between date of cultivation and biomass of corn seedling in pure and mixed crop systems

Cold test

Base on Fig.5 seedling biomass decreased with delaying in each two cultivation systems .Cultivation with delaying in single and mixed systems lead to decrease seedling biomass with 0.44 and 0.49 mg/day respectively. Environmental stress would be increased with planting late. Dornbos and et al [3] expressed that stress lead to decrease the seedling biomass.

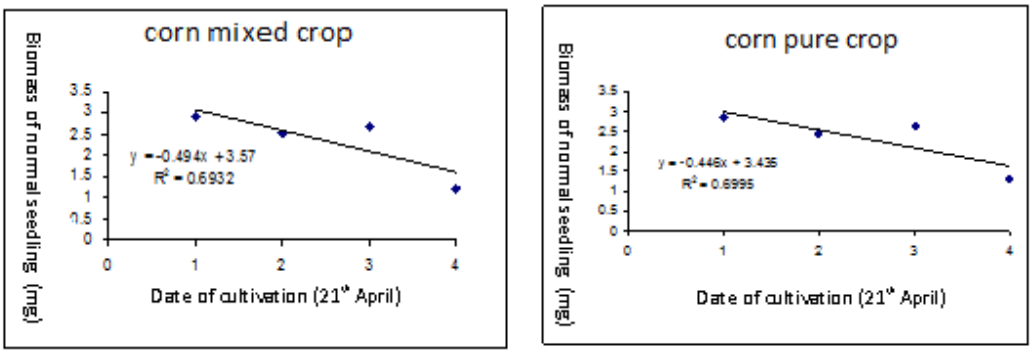

Fig.5 relation between date of cultivation and biomass of corn seedling (cold test) in pure and mixed crop systems

Primary germination

Germination percentage was decreased in late planting in intercropping and mono culture (8.91 and 10.88 percent per day consequently). Jahandide [5] reported similar results. Primary germination indicated the amount of plant cover and light absorption. Latifi,et al [7] and Soltani,et al [13,14] reported same results.

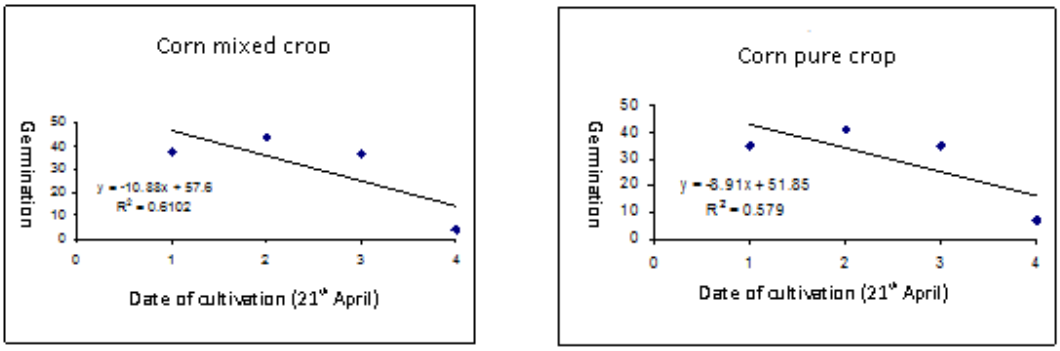

Fig.6 relation between date of cultivation and primary germination percent in pure and mixed crop systems

Germination rate

Late planting decreased germination rate in mono culture and intercropping (2.52 and 2.72, consequently). (Fig.7).

Table 2 – Correlation coefficient of traits different

trait	1	2	3	4	5	6	7	8	9
1-standard germination	1								
2-electrical conductivity	0.89	1							
3-biomass (cold test)	0.86	0.95	1						
4-biomass	0.95	0.86	0.91	1					
5-germination rate	0.99	0.88	0.87	0.97	1				
6-primary germination percent	0.99	0.88	0.87	0.97	0.99	1			
7- Growth rate	0.79	0.64	0.49	0.62	0.75	0.75	1		
8- Growth rate (cold test)	0.91	0.85	0.71	0.77	0.87	0.87	0.94	1	
9-grain yeild	0.99	0.94	0.90	0.94	0.98	0.98	0.70	0.92	1

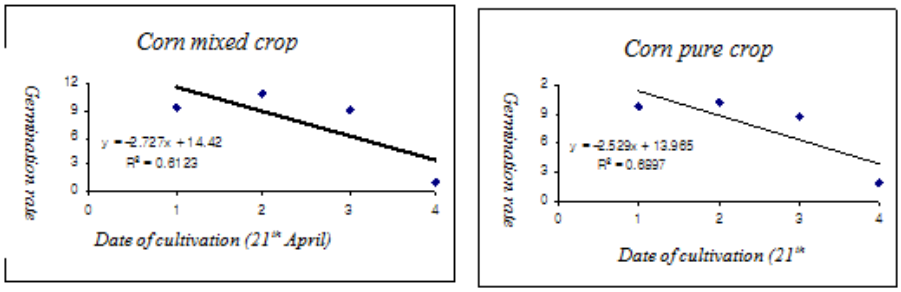

Fig.7 Relation between date of cultivation and primary germination rate in pure and mixed crop system

Finally intercropping affected on all traits significantly. Late planting decrease all traits.

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