EFFECT OF INTERCROPPING SOME GRAIN AND LEGUME CROPS ON THEIR EFFECIENCY IN FIXING SOLAR ENERGY, GROWTH AND YIELD

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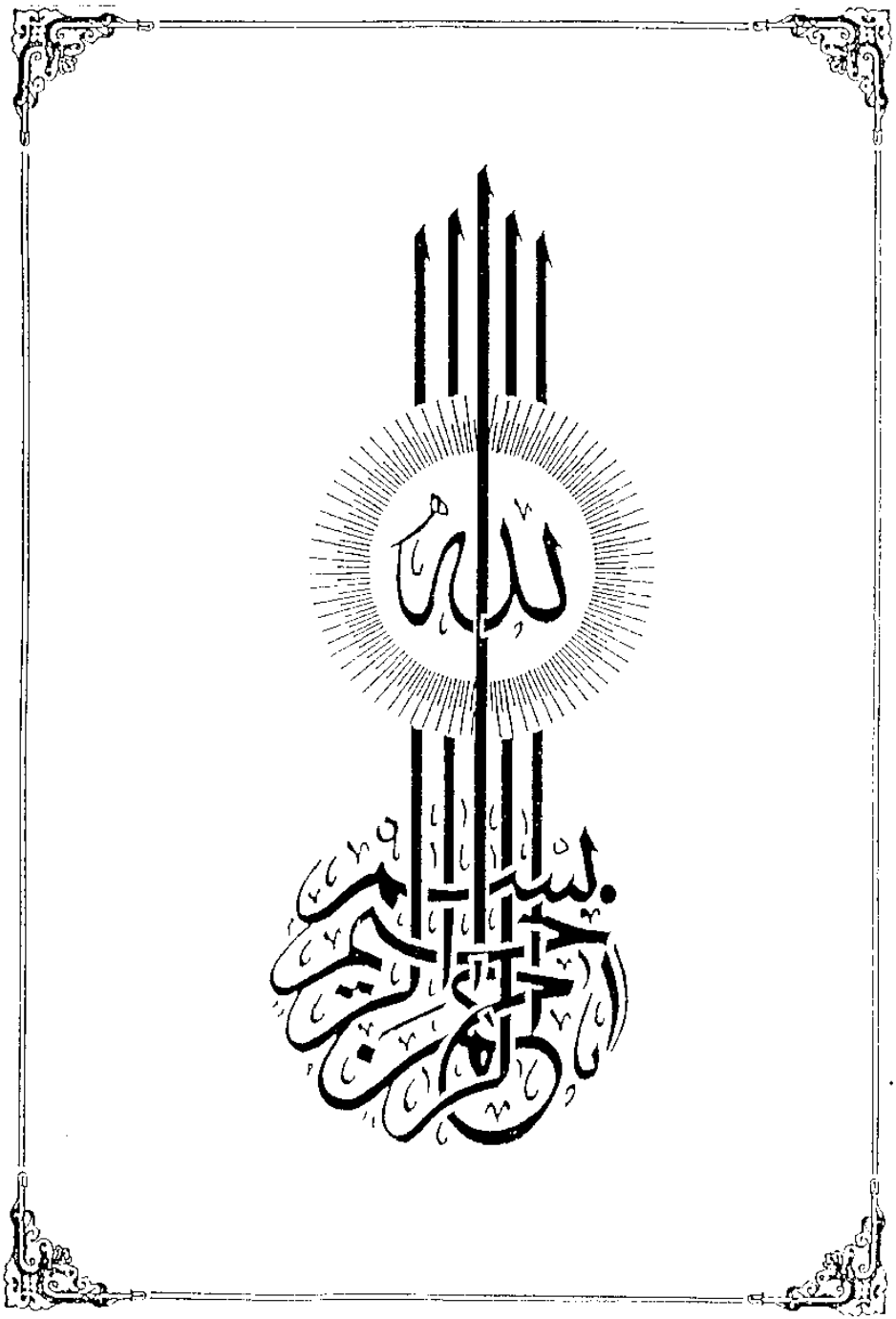

C O N T E N T S

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Introduction

Life is profoundly affected by radiation and the effects are not limited to visible radiations alone. Everyone knows that all life is ultimately dependant on energy stored by photosynthetic plants during the action of sunlight. Plants must make the best use they can of this mixed and variable radiation for the energy they need for photosynthesis.

The astonishing thing about plants is that they avoid such back-reaction and fix light energy in the farm of potential chemical energy in compounds which do not break down spontaneously and which can be stored until required later on for the carrying out of life process.

Sunlight is the major source of radiation affecting organisms. The radiation actually received by a particular surface at any given time consists of direct sunlight and indirect solar radiation from the sky. The radiation reaching the surface of the earth from the sun has a maximum intensity of about 1.6 cal per cm^2 per minute. At the equator the maximum solar radiation which can be received on a horizontal surface varies between 780 and 900 cal per cm^2 per day according to the season. Most of this energy is concentrated in wave length between 600 and 900 millmicrons. The intensity of solar radiation varies, of course, with time of day, weather, season and geographical position.

Several cultural treatments such as, plant population, intercropping, leaf orientation ... etc could be used in increasing the efficiency of plants in fixing solar energy.

In field, plants suffer two kinds of competition, i.e. intercompetition and intracompetition. Intercompetition refers to the competition among plants of the different crops while intracompetition refers to the competition among plants of the same crop. Egyptian farmer used to grow some crops with other ones, i. e. wheat with fenugreek, and onion on the ridges of cotton plants.

The aim of this work is to investigate the effect of growing fenugreek with wheat plants and fenugreek with barley on the efficiency of the crops in fixing solar radiation and on their yield.

Review of Literature

It was found by Mann and Barnes (1) that when barley and clover were grown together with abundance water and nutrients, the presence of even small amount of barley reduced the growth of clover by over 50% but an increase in the density of barley did not increase the effect.

Tewari and Schmid (6) indicated that alfalfa-grass mixtures yielded more forage with slightly higher alfalfa content than the same combinations with alfalfa and grasses in alternate rows 6 inches apart. Growing the alfalfa and grasses as alternate double or triple rows resulted in considerable yield reduction as compared to alternate single rows or mixture. Grass in rows 6 inches from alfalfa rows had higher yield and protein content than 12, 18 or 24 inches from alfalfa row.

Lukashev and Omarw (8) found that soybeans were good with corn for silage wherease Netich, Poavine and Maple pea cannot be used as companion crops with corn for silage.

Oulyaev and Ransol (11) showed that in the mixed sowing of corn and various legumes in all cases, this procedure increased the total weight of both the legumes and the corn, while decreased the yield of corn plants. Protein content in leaf, protein, P and chlorophylle increased.

Harrell (21) found that the unfertilized grass legume mixture gave twice the yield of pure grass, when fertilized with P and S, the mixed produced over 3 times as much as the pure grass. The legume component of the mixture depressed the grass component as a result of competition. He added that N increased grass growth.

Gonzalez et al (27) indicated that increasing rates of N which applied to mixture of barley and vetch increased significantly the content of C, P in both forage and grain of barley but not vetch. The C, P content decreased significantly from the first to the third cut in both species, but was not affected by the mixture proportions.

Habib and Badawy (28) concluded that berseem out-yielded the grasses and berseem/grass mixture in the yield and protein content. Nitrogen applications reduced the yield of berseem and berseem plants percentage in mixtures. Protein content of berseem showed little response to N applications, while the protein content of grasses and berseem/grass mixtures were increased.

Barley when mixed by charlock (Sinapis arvensis) had a higher NAR and leaf area/leaf weight ratio than when in pure stand but the measurements did not reveal large differences in the hight supplies as mentioned by (30).

Nitrogen uptake per plant and per unit root weight was greater in barley than in charlock.

Spring barley undersown with lolium gave a satisfactory production of fodder and organic matter as mentioned by (31). The grain yield of barley decreased by 16.4%, while the straw yield increased by 33.4%.

Singh and Katyal (34) indicated that wheat/grass (Cicer orietinum) mixture gave higher yields than either wheat or grass alone. The highest yields were given by treated plots, followed by untreated control and NP treated plots.

Dayal et al (38) showed that total yield of a mixture of wheat + grass (Cicer orietinum) grown under dry farming conditions in Ragosthan was great than for wheat and grass grown alone.

It was found by Svachula (42) that undersowing of clover in spring barley decreased the grain yield and increased the straw yield and protein content of the grain and straw of barley when compared with barly sown alone.

Effect of seed rate:

The effect of seed rate of barley and wheat on the growth and yield was throughly investigated in different parts of the world. The difference in the environmental conditions under which both barley and wheat are grown necessitates carrying oat investigation on the effect of seed rate on yield of both barley and wheat at different conditions in Egypt.

The seed rate of barley and wheat exerted a marked influence on the plant stand at time of harvest.

The number of wheat plants per unit area become great with increase in seed rate (19). The relationship between number of plants per unit area and the sowing rate was positively linear (7).

The seed rate has a considerable effect on the growth of cereal plants. The number of tillers per plant becomes low with increasing the seed rate of wheat (35) and of barley (5).

Kirby (40) found that high plant density increased the maximum tiller number per unit area but this was followed with different rates of tillers death.

The number of spike, bearing tillers was affected by seed rate (35).

The height of cereal plant increased by decreasing seed rate (12), (49), whereas in other experiments seed rate did not influence the plant height.

The net assimilation rate decreased with increasing barley plants density (5). Increasing plant density decreased the relative growth rate (40).

There was a negative curvilinear relationship between seed rate of both wheat and barley and the seed rate (7).

Increasing wheat plant density caused reduction in number of heads per plant and an increase in number of heads per unit area (12), (50).

Decreasing seed rate of winter barley decreased the number of fertile heads per unit area and increased the number of seeds per head (1,).

The kernal weight become great with reducing the rate of seeding (13).

Middleton et al (17) found no relationship between seed rate and the kernal weight of barley.

Low seed rate increased kernal weight of wheat (49).

The yield of grain was not affected by seed rate within the range of 30 to 140 pounds per acre for barley (3), within the range of seed rate used on barley (17), within the range from 46.6 to 120.3 kg./ha. for wheat (36).

Differences in sowing rates of wheat and barley up to 200 kg./ha. had little effect on total yield.

Reduction in wheat stand reduced the yield (12).

In trials with wheat at 3 locations over 3 years the highest yield of grain occured at a row spacing of 12.5 cm, the lowest at 16.7 cm., while those at 22.2 cm. were intermediate (16).

High sowing rates considerably increased grain yield without fertilizers, whereas only slight yield increased were obtained with fertilizers (44).

Low sowing rate of wheat (22 and 45 kg./ha.) produced especially in years of severe moisture stress produced more grain per ha. than higher rates (67 - 101 kg./ha.) (49).

High seed rate of wheat more than 200 kg/ha. decreased yields and increased lodging.

El-Hattab et al (39) found a reduction in the number of tillers and spikes per plant with increase in wheat plant density. The average weight of grains per spike and the average weight of 1000 kernels did not react significantly to varying the rate of seeding. The total yield of grains and straw, straw yield, and the grain yield per unit area were not significantly affected by varying the rate of seeding.

Effect of nitrogen fertilizer:

Nitrogen fertilizer increased the weight of wheat plant (4), (37) and (48), and number of tillers per wheat plant (15), (37), increased dry matter production during the vegetative growth period (41) and (9).

Increasing levels of nitrogen increased nitrate content, nitrate reductose activity and soluble protein content of leaf tissue (46).

The grain yield of wheat became great with adding nitrogen fertilizer (2), (4),(14), (33) and (37).

Zuev (10) observed that a defficiency of nitrogen during the critical period of spring wheat when the car begins to form has the greatest effect on the formation of structural elements of wheat crop.

Similar conclusion was obtained on barley (22), (45).

The highest grain wheat yield was obtained by applying 30 lb. nitrogen/ac. (24), 45 kg. of nitrogen/hr. in sandy soil (24), while the highest dry matter was obtained by 0 - 45 kg. nitrogen/ha.

Hutcheon & Paul (29) showed that high level of nitrogen had more influence on the growth of straw than grain.

The protein content of grain increased with adding nitrogen fertilizer. This results was true for wheat (4), (14), (18) and (20).

Pleshkov et al (32) indicated that the application of nitrogen drastically raises the content of amino acids