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EFFECT OF SOME MICRO-ORGANISMS AND NITROGEN FERTILIZATION ON GROWTH, YIELD AND ITS QUALITY OF PEAS (*Pisum sativum* L).

E. H. Abou El-Salehein , *.;A. I. Sharaf** and Wafaa, A. Fekry*

** Plant Production Department, Efficient Productivity Institute, Zagazig University, Zagazig, Egypt.*

***Soil Sciences and Water Department, Facility of Agriculture, El-Shatbi, Alexandria University, Alexandria, Egypt.*

ABSTRACT:

Two field experiments were carried out at the Farm of Al-Zawia Zone – Libya in the winter seasons of 2006/2007 and 2007/2008 to study the effect of two micro-organisms (Rhizobium bacteria and yeast fungi) and nitrogen fertilization (100kg/hectare urea, 46.5%N) on plant growth, green pod yield and its components, quality of pods and nutritive value of pea seeds, cv. Master – B. The experiment was included 8 treatments, i.e., control, dry yeast, rhizobuim, urea, yeast + rhizobium, yeast + urea, rhizobuim + urea and yeast + rhizobium + urea.

***The obtained results showed that** the triple treatment of dry yeast, rhizobium and urea fertilization, being the most effective on increased plant growth (plant height and number of leaves/plant), green pod yield and its components (and number of pods/plant ,total green pod yield per plant and per hectare), quality of pods (pod length and number of seeds per pod) and the nutritive value of pea seeds (P and K - contents of seeds). In addition, there are no significant differences between the treatment of rhizobium + urea and dry yeast + rhizobium on average pod weight in the two growing seasons of study and on pod diameter in the first season only. In most cases, the triple treatment was the best on the most of studied characters, followed in descending order by rhizobium + urea and dry yeast + rhizobium. The lowest values of all studied characters was obtained by the control treatment.*

***Conclusively,** it could be concluded that the best treatments for high pea plant growth , green pod yield and its components , quality of pods and chemical contents of seeds (nutritive value) were yeast + Rhizobium + urea , followed by Rhizobium + urea , and yeast + Rhizobium.*

Key words: Peas, microorganisms, N-fertilization , growth, yield.

INTRODUCTION

Pea is a vegetable crop grown in winter as a source of protein for human race. Therefore, many efforts were done towards improving their growth, yield and it's components as well as quality of seeds, through using microorganisms (rhizobium and yeast) and minimizing nitrogen fertilization.

Rhizobium bacteria plays an important role in atmospheric nitrogen fixation and increasing soil fertility (Subba Rao,1986). Rhizobium inoculation treatment increased pea growth, nutrients content, yield and its components as well as quality of seeds (Hassan *et al*., 1993; Abou El-Salehein and Nasr, 1994; Gewailly *et al.,* 1996 and Arisha *et al.,* 1998 on pea, and Marghany, 1999 on snap bean as well as, Abd El-Fattah and Arisha, 2000 on common bean).

Some investigations studied the application of yeast to leguminous seeds, they showed that yeast increased plant growth, chemical composition, green pod yield and its components as well as quality of seeds (Mohamed *et al.*, 1999 and Abou El- Salehein *et al*., 2004 on pea and Fathy and Farid, 1996 on common bean).Moreover, Many investigators illustrated that application of nitrogen fertilizer to leguminous increased plant growth, chemical composition, green pod yield and its components as well as seed quality (El- Beheidi *et al.*, 1984; El-Ghamriny and Arisha, 1992 and Guirgis, 1996 on pea and Salem and Ismail, 1992 on beans). Moreover, many investigators demonstrated that rhizobium X N-fertilization increased most of aforementioned parameters of leguminous plants (Abou El-Salehein and Naser, 1994 and Abdalla *et al.,* 2000 on peas; Hassan *et al.,* 1989 on cowpea and El-Oksh *et al.,* 1991 on common bean).

Therefore, this study was performed to study the response of pea plants to Rhizobium, dry yeast and/or urea fertilization on growth and green pod yield and its components aiming to minimize nitrogen fertilization to decrease pollution.

MATERIALS AND METHODS

Two field experiments were done during 2006 and 2007 winter growing seasons at El-Zawia Zone, Libya, to study the effect of some micro-organisms on growth, green pod yield and its components as well as quality of pea seeds cv.Master-B. Sowing of seeds took place on 2nd and 1st of November in 2006 and 2007 seasons, respectively. Seeds were inoculated at sowing with Rhizobium or dry yeast.

The soil of the experimental field was clay loam in texture. The physical and chemical properties of the soil are shown in Table 1.

Table 1. Physical and chemical properties of the experimental soil.

Characters	Values
Available nitrogen	88 ppm
Available potassium	115 ppm
pH	7.6
Organic matter	0.08 %
CEC(cation exchangeable capacity)	19.0 (meq/100g.soil)

This experiment included 8 treatments as follows:

1. Control , where seeds were not inoculated with rhizobium or dry yeast and plants were not fertilized with N-fertilization.
2. Dry yeast.
3. Rhizobium.
4. Urea.
5. Dry yeast + Rhizobium
6. Dry yeast + urea .
7. Rhizobium + urea .
8. Dry yeast + Rhizobium + urea .

The treatments were arranged in a randomized complete block design (RCBD) with three replicates. The plot area was $8.4m^2$ with four ridges (3.5m.in length and 0.6m in width). One ridge was left between each two plots as a guarded ridge. Wetted seeds were sown 15cm apart in hills on the two sides of ridge in the moderately moist soil. Nitrogen was applied in the form of urea (46.5%).

The experiment was received 100kg/hectare urea (46.5%N) at two equal portions, the first was added during sowing of seeds and the second was added after 21 days from sowing. Moreover, 100kg/hectare calcium superphosphate (15.5%P_2O_5) and 50kg/hectare potassium sulphate (48% K_2O), were added at two equal portions ,15and 30 days from sowing.

The normal cultural treatments of growing pea were practiced as usually followed in the commercial production of green pea pods at Libyan soil condition. Data collected on this experiment were recorded as follows :

a. ***Plant growth measurements*** *:*

A random sample of 10 plants from each experimental plot were taken after 50 days from planting (at full blooming stage) in both growing seasons and plant height(cm) and number of leaves per plant were recorded.

b. Green pods yield and its components :

Weight and number of all harvested pods through out harvesting seasons, were recorded, and number of pods per plant ,average pod weight (g.), total green pod yield per plant (g.) and total green pod yield per hectare (ton) were calculated.

c. Quality of pods :

At the second harvesting time (mid. season), a representative sample of 20 pods from every treatment in all replicates were randomly taken and pod length (cm), pod diameter(cm) and average number of seeds per pod were recorded.

d. Seed chemical contents (the nutritive value) :

NPK contents in seeds were determined at the same time of measurements of quality of pods as follows:

1. Total nitrogen: it was determined as the method described by Kock and Mc Meekin (1924).
2. Phosphorus: it was determined colorimetrically as Troug and Mayers (1939) method.
3. Potassium: it was determined by flame photometer according to Jackson (1967).

Statistical analysis :

The obtained data were statistically analyzed according to Snedecor and Cochran (1980). Means separation was done by Duncan's multiple range test (Duncan, 1958).

RESULTS AND DISCUSSION

a- Vegetative growth:

Data in Table (2) indicate that micro-organisms and urea fertilization significantly increased vegetative growth of peas,i.e. plant height, number of leaves per plant and number of pods per plant.

The treatment of two micro-organisms and urea fertilization (dry yeast + Rhizobium + urea), being the most effective in both growing seasons, following with Rhizobium + urea and dry yeast + Rhizobium. The lowest values of growth characters were obtained as a result of control treatment.

Table 2. Effect of dry yeast, rhizobium, urea and their interactions on plant growth of peas during 2006/2007 and 2007/2008 seasons.

Treatments	Plant height (cm)		No. of leaves / plant	
	2006/2007	2007/2008	2006/2007	2007/2008
Control	55.67g	56.40h	23.07h	23.87h
Dry yeast	60.47e	61.40f	27.33f	28.27f
Rhizobium	65.53d	65.70d	35.57d	35.37d
Urea	58.47f	58.13g	25.83g	26.57g
Yeast + Rhizobuim	70.40c	71.30c	37.40c	37.07c
Yeast + urea	61.50e	62.47e	32.57e	31.53e
Rhizobium + urea	75.89b	74.47b	40.40b	39.33b
Yeast + Rhizobium + urea	79.20a	78.90a	43.60a	42.70a

Values which are indicated with similar alphabetical letters do not differs significantly according the Duncan's Multiple Range Test at 5 % level of significance.

Yeast is a natural source of many growth substances, nutritional elements and organic compounds which enhancing the biosynthesis processes in plant (Nagodawithana, 1991).

In addition, Rhizobium bacteria fixed atmospheric nitrogen and encourage plant growth and building the cells (Pacovesky *et al*., 1991). Moreover, nitrogen plays an important role in metabolism of plant growth through increasing dry matter content of leaves due to increasing their numbers. Leaves could be considered as a metabolic center of the plant efficiency in producing metabolites , consequently , N-increased the capacity of the plant in building metabolites (Bakry *et al*.,1984).

These results coincide with those obtained by (Arisha *et al*., 1998 on peas and Abd El-Fattah and Arisha , 2000 on common bean , regarding Rhizobium,

Mohamed *et al*., 1999 and Abou El-Salehein *et al*., 2004 on peas and Fathy and Farid , 1996 on common bean, respecting yeast, El-Ghamriny and Arisha , 1992 and Guirgis, 1999 on peas and Salem and Ismail, 1992 on beans, regarding N-fertilization and Abou El-Salehein and Naser , 1994 and Abdalla *et al* ., 2000 on peas respecting Rhizobium + N-fertilization).

b- ***Green pod yield and its components*** **:**

Data presented in Table (3) indicated that the micro-organisms (yeast + Rhizobium) with N-fertilization (yeast + Rhizobium + urea) resulted in the heaviest green pod yield of pea and its components compared with the other treatments followed by Rhizobium + urea and yeast + rhizobium.

There are no differences between the treatment of Rhizobium + urea or yeast + Rhizobium on average pod weight in both growing seasons. In addition, the lowest values were recorded from control treatment.

The increase in total green pod yield of pea, i.e. weight of pod , green pods yield per plant and per hectare, as a result of yeast + rhizobium + urea to pea plant might be attributed to the increase in the vegetative growth of plants (Table 3).

These results are in agreement with those reporded by (Hassan *et al*., 1993; Abou El-Salehein and Naser, 1994; Gewailly *et al.*, 1996 and Arisha *et al*., 1998 on peas and Merghany, 1999 on snap bean, as well as, Abd El-Fattah and Arisha, 2000 on common bean regarding Rhizobium, Mohamed *et al*., 1999 and Abou El-Salehein *et al*., 2004 on peas and Fathy and Farid , 1996 on common bean respecting yeast, El- Mansi *et al*., 1984; El- Ghamriny and Arisha, 1992 ; Abou El- Salhein and Naser, 1994 and Guirgis, 1999 on peas and Salem and Ismail, 1992 on beans regarding N-fertilization and Abou El-Salehain and Naser, 1994 and Abdalla *et al.*, 2000 on peas and Hassan *et al* , 1989 on cowpea and El- Oksh *et al* ., 1991 on common bean with regard to Rhizobium + N-fertilization.

c- Quality of pods :

Data presented in Table (4) show that application of yaest + rhizobium + urea increased the quality of pea pods , i.e. pod length and number of seeds per pod compared with other studied treatments in both growing seasons. There is no deferent between the treatment of yeast + rhizobium + urea or the treatment of rhizobium + urea on pod diameter of pea in both growing seasons. Obtained data are coincided with those of Abou El-Salehein *et al*.(2004); Arisha *et al* .(1998) and El- Ghamriny and Arisha (1992) , respectively.

d- Chemical composition in seed (nutritive value) :

Data in Table (5) show clearly that all used treatments had a marked effect on chemical content of pea seeds, compared with the control treatment. The highest values of P and K were obtained by application of yeast + rhizobium + urea followed by Rhizobium + urea respecting P only and Rhizobium + urea or yeast + Rhizobium regarding K, in both growing seasons. On the other hand , the highest value of N-content in first season was obtained by application of Rhizobium only, followed by triple treatment or both Rhizobium and urea or yeast , and in the second seasons , by application of yeast + Rhizobium + urea , followed by Rhizobium + urea or yeast + Rhizobium. The results are agree with those reported by Mohamed *et al.*(1999) who used yeast , El- Ghamriny and Arisha (1992) with Rhizobium and El-Beheidi *et al.* (1984) with N- fertilization.

Conclusively, it could be concluded that the best treatments for high pea plant growth , green pod yield and its components , quality of pods and chemical contents of seeds (nutritive value) were yeast + Rhizobium + urea , followed by Rhizobium + urea and yeast + Rhizobium.

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تأثير بعض الكائنات الدقيقة والتسميد النتروجيني علي النمو، المحصول وجودته لنباتات البسلة

عصام حسين أبوالصالحين*،أحمد أسماعيل شرف،وفاء عادل فكري***
* قسم الإنتاج النباتي- معهد الكفاية الإنتاجية- جامعة الزقازيق- الزقازيق- مصر.
**قسم علوم الأراضي والمياه - كلية الزراعة – الشاطبي- جامعة الأسكندرية – الأسكندرية- مصر.

أجريت تجربة حقلية في شتاء موسمي ٢٠٠٦/٢٠٠٧،٢٠٠٧/٢٠٠٨ في أحدي مزارع مدينة الزاوية –ليبيا لدراسة تأثير أثنان من الكائنات الحية الدقيقة (بكتيريا الريزوبيوم وفطر الخميرة)والتسميد النيتروجيني (١٠٠ كجم / هكتار ،يوريا،٤٦.٥ % نيتروجين) علي نمو النبات،محصول القرون الخضراء ومكوناته ، جودة القرون والقيمة الغذائية للبذور صنف ماستر -٠ ب .
اشتملت التجربة على ٨ معاملات هى المقارنة، الخميرة الجافة، الريزوبيوم، اليوريا، الخميرة + الريزوبيوم، الخميرة+ اليوريا، الريزوبيوم+ اليوريا، الخميرة+ الريزوبيوم + اليوريا.
اوضحت النتائج المتحصل عليها أن المعاملة الثلاثية للخميرة الجافة و الريزوبيوم والتسميد باليوريا ،كانت الاكثر فعالية فى زيادة النمو (ارتفاع النبات ،عدد الأوراق،) ،محصول القرون الخضراء ومكوناته (عدد القرون/نبات ،محصول القرون الخضراء الكلية / نبات ،محصول القرون الخضراء/هكتار) ،جودة القرون (طول القرن وعدد البذور فى القرن) والقيمة الغذائية للبذور (محتوى البذورمن الفوسفور والبوتاسيوم).
اضافة الى ذلك ،لايوجد اختلافات معنوية بين المعاملتين الريزوبيوم +اليوريا و الخميرة الجافة + الريزوبيوم بالنسبة لمتوسط وزن القرون في كلا موسمي الدراسة ،وفى الموسم الاول فقط بالنسبة لصفة قطر القرن.
معظم الحالات كانت المعاملة الاولى هى المعاملة الثلاثية التى اثرت على الصفات المدروسة يليها فى ذلك الريزوبيوم +اليوريا ثم الخميرة الجافة + الريزوبيوم ،على الترتيب. أعطت معاملة المقارنة أقل القيم بالنسبة للصفات المدروسة.