Physiological studies on pea

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Two field experiments were conducted at the Experimental Farm of the Faculty of Agriculture, Moshtohor, Zagazig University during the two successive winter seasons of 1996 - 1997and 1997 - 1998 This study aimed to investigate the effect of plant density,NP fertilizer levels, Rhizobium (Rh) and mycorrhizae (VAM) onvegetative growth, chemical constituent, green pods yield and itsquality of pea (Pisum sativum 1..) cv. Littel Marvel. The obtainedresults in this study could be summarized as follows:1. First experiment:This experiment was conducted to investigate the effect ofplant density, NP fertilizers and their interaction on growth,chemical constituents, green pods yield and its quality. It included9 treatments which were the combination of three plant densities,i.e. 30 , 45 and 60 kg seeds / fed. and three N P fertilizer levels ,i.e.15 - 15, 30 - 30 and 45 - 45 kg N P / fed., respectivelyObtained results were as follows:I. Plant vegetative growth:I.Using 30 kg seeds / fed. increased all the studied morphologicalcharacteristics of pea plant, i.e, no. ofleaves and branches aswell as fresh and dry weight per plant except plant length whichwas increased with using the highest seeding rate (60 kgseeds/fed.)2. Application of the highest used level of nitrogen and phosphorusfertilizer (45 - 45 kg N P / fed.) resulted in the highest values ofdifferent studied growth characteristics of plant.3. Using 30 kg seeds/fed. interacted with the application of thehighest used levels of N and P fertilizers (45 - 45kg/fed.)reflected the highest values of most studied plant growth parameters.II. Chemical composition of plant:1. Photosynthetic pigments :1. The highest values of chlorophyll a, b, and total chlorophyllwere obtained by using the lowest plant density (30 kgseeds/fed.). The content of photosynthetic pigments wasgradually increased by decreasing plant density rate from 60 kgto 30 kg seeds / fed. On the other hand, the highest values ofcarotenoids content were obtained by the highest plant density,i.e. 60 Kg seeds / fed.2. Chlorophyll a , b and total as well as carotenoids in leavescontent was significantly increased with increasing nitrogen andphosphorus fertilizer level from 15-15 up to 45 - 45 Kg NP/ fed.3.There was an increase in a, b and total chlorophyll by using 30Kg seeds / fed. within NP fertilizer level at 45 - 45 Kg / fed., butthe highest carotenoids content was obtained by 60 Kg seeds /fed. with the same level ofNP fertilizer. Such increases did notreach the level of significancy during both seasons of growth .2. Total N,P and K concentration and uptake per plant:1.Using 30 Kg seeds / fed. resulted in the highest values ofN, Pand K as a concentration or uptake by plant compared with theother seeding rates.2.The highest concentration and uptake of N, P and K wasobtained by application ofNP fertilizer at its highest used level(45 - 45 Kg / fed.).3. There was an increase in N, P and K concentration and theiruptake in plant tissues as a result of the application of30 Kgseeds / fed. within 45 - 45 Kg NP/ fed., but these increases didnot reach the 5 % level of significance.III. Green pods yield and its components: 1. Increasing seeding rate from 30, 45 up to 60 kg seeds / fed.significantly and gradually decreased the values of each ofnumber of pods / plant, green pod weight, and total green podsyield / fed.2. Increasing level of NP fertilizer from 15 - 15 to 45 - 45 KgNP/fed. produced the highest values of different studied yieldcomponents of pea.3. Sowing 30 Kg of seeds / fed. in combination with the applicationof NP fertilizer at 45 - 45 Kg / fed. increased the total yield andits components but such increases did not reach the level ofsignificanty ,except in case of number of pod / plant during thesecond season only.IV. Yield quality :1. physical pods characteristics:1. Using 30Kg seeds / fed. significantly increased average podlength and diameter , number of seeds per pod weight of 100-seeds, netting percentage and dry matter percentage ofproduced seeds.2. Addition of 45 - 45 NP Kg / fed. gave the highest values for allthe studied physical pod

characteristics.3. Sowing seeds at 30Kg seeds/ fed. within NP fertilizer applicationat level of 45-45 NP Kg / fed. increased all the determinedphysical pods characteristics, but such increases reached thelevel of significancy in case of number of seeds/ pod during thefirst season and pod length during the second one .2. Seed quality characteristics (The nutritional value):I. Total N, P and K concentrations and their uptake:1. Sowing 30 Kg seeds/fed. significantly increased the N , P and Kconcentration in seeds .812. Application of 45 - 45 Kg NP / fed. was the most effective levelshowing the highest values ofN , P and K seeds content.3.The seed content of, N, P and K was increased according tocombination between sowing rate at 30 Kg seeds / fed. withinNP fertilizer level at 45 - 45 Kg / fed., but these increases didnot reach the 5 % level of significance.II. Reducing, non reducing and total sugars percentage:I. Decreasing sowing rate to the lowest used one, i.e, 30 Kgseeds/fed. resulted in the highest percentage of reducing, nonreducing and total sugars in seeds.2. Application of the highest used level of NP fertilizers, i.e,45 - 45 Kg NP / fed. increased reducing, non reducing and totalsugars percentage in pea seeds.3. Sowing 30 Kg seeds / fed. within application ofNP fertilizer at45 - 45 Kg NP / fed. was of more increasing reducing, nonreducing and total sugars percentage. However, these increaseswere insignificant.III. Protein and total carbohydrates percentage:I. The lowest used rate of seeds (30 Kg / fed.) resulted in thehighest percentage of either proteins or carbohydrates in peaseeds.2. Increasing NP fertilizers level from 15 - 15 up to 45 - 45 Kg /fed. showed clear effect on the percentage of either proteins orcarbohydrates in pea seeds.3. The lowest used rate of sowing seeds (30 Kg / fed.) incombination with the highest used level of NP fertilizer(45 - 45 Kg / fed.) caused increases in the values of both proteinand carbohydrates percentages, but these increases wereinsignificant 2. Second experiment:This experiment included 16 treatments which were thedifferent combinations of mineral fertilizers .i.e, N , P andbiofertiliz.ers .i.e. Rh and VAM in addition to the control treatment .. It aimed to investigate the effect of mineral fertilizers and / orbiofertilizers as well as their combinations on vegetative growthand chemical composition of plant foliage, total green pods yieldand its component as well as green pods physical characters andnutritional value of green seeds . Obtained results can besummarized as follows.I. Plant vegetative growth:Using nitrogen or phosphorus fertilizer either in a single orcompound form, in combination with Rh or VAM, and / or withboth of them, increased all the studied morphologicalcharacteristics of pea plants, i.e. plant length, number ofleaves andbranches per plant and fresh and dry weight per plant as well asnumber of nodules per root of plant. In this respect, treatmentincluded the combination of all studied fertilizers (N+P+Rh+ VAM)reflected the maximum increments of such studied growth aspects.II. Chemical composition of plants:1. Photosynthetic pigments of leaves :The highest values of chlorophyll a , b and total chlorophyllas well as carotenoids were obtained by the application of the usedmineral fertilizers combined with the applied biofertilizers (N + P+ Rh + VAM) treatment .2. Minerals content of plants :Applying N + P + Rh + VAM seemed to be the most effectivetreatment on the concentration of N, P and their total uptake inplant.III. Green pods yield and its components:Applying N, P , Rh and VAM each of them alone and / ortheir combinations significantly increased the total green pods yieldand its components of pea .i.e. number and weight of green podsper plant and average green pod weight . Moreover, treatmentincluded N+ P + Rh + VAM , being the most effective one on yieldand its components.IV. Seed and pod quality :1. physical pod characteristics:Addition of nitrogen and phosphorus combined with Rh andYAM (N + P + Rh + VAM) significantly increased physical podand seed characters .i.e. average pod length and diameter, numberof seeds per pod , netting percentage, seed index and dry matterpercentage of seeds.3. Seed quality (the nutritive value) :The concentration of N, P , reducing, non reducing andtotal sugars as well as protein and total carbohydrates percentagewere markedly affected by the studied treatment. The treatment ofN + P + Rh + VAM was the most effective one which resulted inthe highest values of seed chemical constituents in both growingseasons.It may be stated that, under such combinations applying eithermineral fertilizers or biofertilizers in a single or combined formmay be recommended for obtaining pea plants of the bestvegetative growth , chemical composition, total green pods yieldand its components as well as best nutritive value for producedseeds because all used fertilization treatments supposed the controlone in the different studied character . In this respect, thecombination of mineral and biofertilizers treatment(N + P + R h + VAM) reflected the maximum

increments in allstudied growth and yield aspects.However , it may be suggested that the treatment where thenitrogen fertilizer was not supplied with other used fertilizers (P +Rh + V-AM) may be advisable because it was the second one or ofthe second rank after that of (N + P + Rh + VAM) . Such adviceto use this treatment is based on (1) The variation in produced yieldor the less yield than that the first one is not too much (2) to avoidpolution and hermfull effect of nitrogen on the edible part (greenseed) to encourage clear vegetable production (3) from theeconomical point of view througth no application of nitrogen, theless in yield which is not more than 200 Kg Ifed. may cost thesame as the quantity of the used nitrogen fertilizer.