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INFLUENCE OF NUTRIENTS AND WATER STRESS ON GERMINATION OF SOME PEA CULTIVARS *Pisum sativum*

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ABSTRACT

An investigation was conducted to study the germination behaviour of different Peas cultivars under a combination of NP solution and a water-stress treatments. Results indicate that the nutrient combination treatments caused in the non-significant increase in the germination rate, radicle length and the radicle speed elongation, in addition to the ubnormal seedling.

Significant differences were found among cultivars in their water stress resistance as mean germination time, drought resistance index, and germination rate.

INTRODUCTION

Dry edible or green peas, is an important crop economically. In addition, It's high nutritional values in which contain high amount of protein with two valuable amino acids, cysteine and methionine. The crop had been cultivated for food and Feed (1,2,3). It plays a significant role in the farming system and atmospheric nitrogen fixation. Pea usually associated with Rhizobium leguminosarum (2).

Temperature during germination with the amount of food reservior are the two important Factors determing germination, growth of transplants (3,4).The germination and growth of pea are well adapted to a low temperature and 23.9 °C being optimum . The growth rate of seedling increases as the temperature elevated. At high temperature, microbial activities may affect seedling viability (4), however, it had been found that the germination of peas seeds do occur in the range between 2-25 °C (5,6).

There are a negative relationship between percentage germination and water potential (3,7). A different concentration of a nutrient solution containing nitrogen and phosphorus have shown no influence on percentage of ubnormal seedlings, rate of germination, length of radical and epicotyle, and over all growth (8).

Drought can be defined in a general term meaning a sustained period of significant

ubnormal supply of water or low moisture availablity (3).

Adaptive resistance to moisture stress in pea is important due to the condition of rainfed cultivation during the winter–spring conditions especially during seedling growth. A wide varieties of literature have covered mesophytes in this respects (3,8,9). Drought resistance mechanisms can be attributed to desiccation postponement or to desiccation tolerance(9). In legumes such as pea, the first effects of moisture deficit is a cessation of stem elongation and enlargment of leaves and pods. In addition symbiotic nitrogen fixation is very sensitive to moisture stress (3).

This investigation had been conducted to evaluate some pea cultivars seeds and seedlings to several concentrations of nitrogen and phosphorus and their interaction and their preformanes under elevated moisture stress.

MATERIALS AND METHODS

A Laboratory study was conducted using three pea cultivars *Pisum sativum*, namely little marvel, leaf less- filby and Italian. A stock solution of urea (46.4% N) and sodium Orthophosphate di-Hydrogen (98% P_2O_5) were prepared. Seeds were germinated in an incubator at 24°C using distilled water as a control, and 10 PPM N+5 PPM P , 10 PPM N+10 PPM P, 15 PPM N+5 PPM P and 15 PPM N+10 PPM P as treatments .The experiment was designed according to C.R.D. with three replications. Comparisons among means were conducted using least significant difference test (LSD) at 5% level and percentage results were converted to a degree.

In addition, seeds of above Cultivars were tested for germination under drought conditions using NaCl solutions (58.44 g of NaCl/Liter) which produce a water potential of (-4.32 mega Pascals). i.e,(-42.62bars). A concentration of 0.00;-0.374,-0.749;-1.124; -1.498, and –1.800 Mpa were used, in three replicates. Mean germination time (MGT) were calculated according to the following equation:

$$MGT = \frac{I}{N} \quad nidi$$

In which ni = number of seeds germinated at day i, di is the rank order of day i, and N is the total number of germinated seeds (12).

RESULTS & DISCUSSION

Table 1 represent a comparison between the two cultivars, leaf less and little marvel. It shows that leaf less possess more ubnormal seedling, higher length of hypocotyle, the speed of hypocotyle elongation in cm/day and finally higher dry weight accumulation significantly in comparison to little marvel.

The total time required for germination was eight days. Eventhough, seeds of leaf less. Were germinated in less than 24 hours, which may related to genetic and physiological factors (3,4).

As the temperature increases during germination time, the time required for germination decrease (6,10). Previous work had indicate the same results (8).

The influence of nitrogen-phosphorous combination is shown in table 2.The results were non significant, but it is apparent that the 10 PPM N+5 PPM P treatment had resulted in the increase,of ubnormal seedling, length of radicle and the speed of radicle growth.

Tables 3 represent the influence of nitrogen treatment on percentage germination and seedling characters. It shows that 10 ppm

nitrogen had produced non significant high ubnormal seedling. The same result had been recorded for 5ppm phosphorous as shown in table 4.It had been recorded previouslly that nutrient solution of the same concentration have no significant effects on seedling characters (8).

Table 5 represent the influence of water stress on mean germination time.The high MGT figure of zero stress shown by all three cultivars, with respect to the interactions within cultivars and water stress treatments, leaf less gave the maximum MGT under (Zero Mpa) while the minimum MGT observed for the same variety or cultivars under (-1.108 Mpa). The Cultivars may indicate that the germination of pea required an absorption of certain minerals for imbibition and then for germination. However low water stress seeds have germinated gradually during first twelve days, while high water stress seeds have germinated in a short eight days which resulted in a high mean germination for low stress treatments in comparison with high stress treatment .

In general it seems that little marvels have less ability to germinate under drought condition in comparison with the two other Cultivars (higher MGT figure mean low resistance to stress).

Table 1: Percentage germination and seedling character of cultivars, leaf less and little marvel.

cultivars	% Germination	% ubnormal seedling	Length of radicle (cm)	Length of hypocotyle (cm)	Speed of elongation of radicle cm/day	Speed of elongation of hypocotyle cm/day	Speed of germination (Seedling/day)	Dry weight (g)
Leaf Less	90	21.14	4.96	4.87	0.61	0.60	2.21	1.40
Little marvel	90	7.04	6.22	3.66	0.77	0.45	2.12	1.25
L.S.D 0.05	N.S	11.99	N.S	1.11	N.S	0.13	N.S	0.10

Table 2: The influence of nutrient solution combination on the percentage germination and seedling characters.

Treatment concentration (PPM)	% Germination	% ubnormal seedling	Length of radicle (cm)	Length of hypocotyle (cm)	Speed of elongation of radicle cm/day	Speed of elongation of hypocotyle cm/day	Speed of germination (Seedling/day)	Dry weight (g)
Control	90	5.87	5.62	5.03	0.69	0.62	2.15	1.51
10PPM(N)+5 PPM(P)	90	23.49	6.94	4.47	0.86	0.55	2.25	1.38
10PPM(N)+10 PPM (P)	90	11.74	4.01	3.64	0.49	0.45	2.13	1.52
15PPM(N)+5 PPM(P)	90	11.74	6.19	4.60	0.77	0.57	2.13	1.50
15PPM(N)+10 PPM(P)	90	17.62	5.18	3.59	0.64	0.44	2.15	1.40
L.S.D. 0.05	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 3: The influence of nitrogen concentration on percentage germination and seedling characters.

Concentration	% Germination	% ubnormal seedling	Length of radicle (cm)	Length of hypocotyle (cm)	Speed of elongation of radicle cm/day	Speed of elongation of hypocotyle cm/day	Speed of germination (Seedling/day)	Dry weight (g)
Control	90	12.72	5.59	4.44	0.69	0.54	2.16	1.46
10 PPM(N)	90	17.62	5.48	4.05	0.68	0.50	2.19	1.45
15 PPM(N)	90	14.68	5.68	4.04	0.70	0.50	2.14	1.44
L.S.D. 0.05	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table 4: The influence of phosphorus concentration on percentage germination and seedling characters.

Concentration	% Germination	% ubnormal seedling	Length of radicle (cm)	Length of hypocotyle (cm)	Speed of elongation of radicle cm/day	Speed of elongation of hypocotyle cm/day	Speed of germination (Seedling/day)	Dry weight (g)
Control	90	12.72	5.59	4.39	0.69	0.54	2.16	1.46
5 PPM(P)	90	17.62	6.57	4.53	0.81	0.56	2.19	1.44
10 PPM(P)	90	14.68	4.59	3.61	0.56	0.44	2.14	1.46
L.S.D. 0.05	N.S	N.S	N.S	N.S	0.05	N.S	N.S	N.S

Table 5: The effect of water-stress in term of salt-concentration in Mpa on mean germination time of seeds of the three cultivars.

cultivars	Water stress – (Mpa)					
	0.0 (Mpa)	-0.369 (Mpa)	-0.739 (Mpa)	-1.108 (Mpa)	-1.478 (Mpa)	-1.800 (Mpa)
Leaf less	7.3	5.8	5.8	4.5	5.1	5.3
Little marvel	6.9	6.5	6.6	6.3	6.6	5.3
Italy	5.3	4.9	4.8	4.8	5.0	4.6

$LSD_{.05}=0.15$

Table 6 show the drought resistance index calculated based on percentage germination under water stress relative to that of complete 100% germination which indicate also, that little marvel seeds have a very low drought resistance.However, under zero stress it shows that infact this cultivar have a low percentage germination. Italian have the highest even under very high stress.It is of an importance to evaluate genetic resource for adaptation against water-stress, specially for crops adapted to rainfed cultivations (12,13) under agricultural environment seeds, seedling and crop-plants are usually exposed to stress. Some factors may become stressful in just a short time, others may take longer time .Thus stress plays a major role in determining how soil and climate limit the cultivation and distribution of crops and plants species and cultivars (9).As shown previouslly in table 5 and 6, Italian has shown the highest drought resistance in term of mean germination time and germination ratio.

Table 7 leaf less cultivar was next, and little marvel was the lowest with all significantly. Infact little marvel was shown 45.06% reduction in germination time.

Table 8 represent the effects of water-stress on average mean germination time of all the three Cultivars and germination rate, the most knowticable is the great reduction in germination rate as the water stress increases

Table 6: Drought resistance index of the three cultivars.

cultivars	Water stress – (Mpa)					
	0.0 (Mpa)	-0.369 (Mpa)	-0.739 (Mpa)	-1.108 (Mpa)	-1.478 (Mpa)	-1.800 (Mpa)
Leaf less	0.95	1.00	1.00	0.85	0.75	0.45
Little marvel	0.60	0.65	0.60	0.40	0.25	0.15
Italy	1.00	0.95	0.90	0.90	0.80	0.65

Table 7: The effect of water-stress on mean germination time and germination ratio of seeds of three cultivars.

cultivars	Mean germination time	Germination ratio
Leaf-less	5.64	72.63
Little-marvel	6.37	41.80
Italy	4.91	75.13
L.S.D 0.05	0.15	13.36

Table 8: The influence of water-stress treatment on mean germination time and germination ratio.

Water-stress (Mpa)	Mean germination time	Germination ratio
0.00	6.50	74.71
-0.369	5.73	77.97
-0.739	5.73	72.49
-1.108	5.20	62.97
-1.478	5.56	51.14
-1.800	5.06	38.65
L.S.D 0.05	0.15	13.36

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پەسەند کرا لە ٢٠٠٠/٧/١٠دا

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کاریگەری خۆراکدەری شل و فشاری ئاو لەسەر ڕێژەی چەکەرە کردنی چەند پۆلێك لە پۆڵگە *Pisum sativum*

نوری حەسەن غەفور
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پوخـــتە

سروشتی چەکەرە کردنی چەند پۆلێك لە ڕووەکی پۆڵکە لە ژێر کاریگەرێتی هاو ئاهەنگی نێوان مامەڵەی خەستی جیاواز لە نایترۆجین و فسفۆر خرانە ژێر لێکۆڵینەوە جگە لە چەند مامەڵەیەکی فشاری ئاو .

ئەنجامی لێکۆڵینەوەکە دەری خست کە مامەڵەی هاو ئاهەنگی جیاواز لە نایترۆجین و فسفۆر دەبێتە هۆی بەرزکردنەوەی تێکڕایی چەکەرە کردن و درێژی ڕەگۆکەو تێکڕایی درێژ بوونی ڕەگۆکە لەگەڵ چەکەرەی نائاسایی بە شێوەیەکی نابەرجەستەیی .

جیاوازی بەرجەستەیی لە نێوان پۆڵەکان دا بەدی کرا لە ڕووی بەرگریانەوە بۆ فشاری ئاو وەك تێکڕایی کاتی پێویست بۆ چەکەرە کردن و نیشانە دەرکەوتووەکانی بەرگری کردن لە وشکی و تێکڕایی چەکەرەکردن .

تأثير بعض المغذيات والجهد المائي على نسبة الإنبات لبعض أصناف البزاليا *Pisum sativum*

نوري حسن غفور
كلية العلوم / قسم البايولوجي

الخلاصة

تم تقييم طبيعة إنبات بذور بعض أصناف البزاليا تحت تأثير التداخل بين معاملات تراكيز مختلفة من النيتروجين و الفسفور بالإضافة الى معاملات مختلفة من الجهد المائي.

دلت النتائج على أن المعاملات المتداخلة المختلفة من النيتروجين و الفسفور أدت الى زيادة غير معنوية التأثير على معدلات الإنبات، طول الجذير وسرعة إستطالة الجذير بالإضافة الى البادرات الشاذة.

وجدت فروقات معنوية بين الأصناف في مقاومتها للجهد المائي كمعدل الزمن اللازم للإنبات، دليل مقاومة الجفاف و معدل الإنبات .