J. Agric. Sci. Mansoura Univ., 25 (12): 7325 - 7334, 2000.

EFFECT OF SEED COATING WITH SOME MICROELEMENTS ON THE YIELD QUALITY AND QUANTITY OF PEARL MILLET CROP

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ABSTRACT

Two field experiments were carried out at Giza Experimental Agricultural Research Station, Agricultural Research Center in 1998 and 1999 growing seasons to study the effect of some microelements by seed coating method on yield quality and quantity, some morphological and physcicological characters of pearl millet (shandawil-1 cultivar). Treatments of microelements (i.e. Zn, Mn and Fe) at two rates 0.2 and 0.4 g/kg seed by grain coating method used with control treatment (seeds without microelements).

Plant height, seasonal fresh fodder, crude protein, ash and chlorophyll A and B were increased significantly with application of Zn, Mn and Fe at the rate of 0.4 g/kg seed of all cuts. Seed coating by Fe and Zn at rate of 0.4 g/kg seed showed noticeable increment on dry yield, seasonal dry yield and leaf area at the three cuts. The highest plant height, leaf area, fresh fodder, dry fodder, crude protein, ash, chlorophyll A, B and up take of Zn were obtained by application of Zn at the rate of 0.4 g/kg seed of all cuts. Dry forage yield showed positive and high significant correlation with all characters under study except crude fiber percentage.

Keywords : Seed coating, Zinc, Iron, Manganese and pearl millet

INTRODUCTION

Fodder crop is of the major important stable feed crop in the summer seasons in Egypt. The increased deficiency of green forage in the summer requires more attention to study factors affecting growth of forage pearl millet. In the last two decades, several investigators reported good response of different crops for microelements fertilization in Egypt. Kumar *et al* (1986) found that zinc had a synergistic effect on the concentrations of Fe and Mn in leaves, stems and roots up to 10 ppm Zn in pearl millet. Raj *et al* (1989) concluded that applying 5 kg Zn as zinc sulphate/ha gave yields of 35.5 t fresh fodder and 9.04 t DM/ha compared with 24.3 and 6.62 t, respectively without Zn. Yadav *et al* (1989) reported that (dry or fresh) yields with 0, 5 and 10 kg Zn/ha were 1.00, 1.14 and 1.93 t, respectively. Increasing Zn rates increased Zn contents in both grain and stover, N and Zn uptake of peral millet. Belavanaki *et al* (1990) stated that application of 10 kg $FeSo_4$ gave the highest sorghum fodder yield 9.48 t. Osman *et al* (1991) found that coating method of applicating Zn, Mn and Fe on faba been increased plant shoots dry weight. They also found that Zn, Mn and Fe uptake of shoots was increased by coating method. Attia et al (1992) indicated superior effect on dry matter production by micronutrients coating method. Ashoub *et al* (1998) indicated that using grain coating method in maize caused significant increment in plant height, dry weigh of plant, Zinc uptake, manganese uptake, iron uptake and protein content in grain. They also found that significant increments in all traits with grain coating compared with foliar spraying application.

MATERIALS AND METHODS

Two field experiments were conducted in the Experimental Agricultural Research station, Agricultural Research Center, Giza Governorate during 1998 and 1999 summer seasons to study the effect of seed coating with some microelements on yield quality and quantity of pearl millet (Shandwil-1 cultivar). The soil was clay in texture with pH of 8.0, 1.5% organic matter and having 0.94, 5.1 and 4.2 ppm available Zn, Fe and Mn, respectively, average of the two season for the upper 20 cm of the soil. The experiments were laid out in randomized complete blocks design with four replications. Each plot was 12 m^2 and included 12 rows (20 cm a part). Microelements application were, control (without microelements), grain coating by Zn or Mn or Fe at rate of 0.2 and 0.4 g/kg seed in a form of EDTA. The preceding crop was Egyptian clover and sowing date was 17th and 15th May in the first and second seasons, respectively at rate of 10 kg/fed. Nitrogen fertilizer was applied in the form of ammonium sulphate (20.6% N) at a rate of 120 kg N/fed in three equal splits after 21 days from sowing and after the first and second cuts. Potassium sulphate at a rate of 50 kg K_2O/fed and calcium superphosphate at a rate of 30 kg P_2O_5/fed were added before sowing. The other cultural practices were done as recommended. The first sample (Whole plant) were collected after fifty days of cultivation then samples were collected consequently every forty days. Whole plant samples were cutting into equal parts after that all parts were analyzed. The studied characters included: -

A- Growth character:- At each cut, ten plants were taken randomly from each plot just before each cut and the following growth characters i.e., plant height (cm), leaf area (cm^2) was measured by using portable area meter and relative growth rate (R.G.R) (g/week) was measured according to the following equation.

R.G.R = $\log_n w_2A_2 - \log_n w_1A_1 / t_2 - t_1$ (g/ /week) where W_1, A_1 and W_2, A_2 refere to dry weigh the whole plant and blade leaf area at time t_1 and t_2 in weeks, respectively.

B-Forage yield : - Three central rows of each plot were clipped to determine fresh and dry forage (ton/fed) at each cut.

C-Forage quality: - Sample for the determination of the whole plants crude protein (CP%), crude fiber (CF %) and Ash %. The chemical analysis followed by A.O.A.C. (1980). Zn, Mn and Fe were determined by atomic absorption spectrophotometeric according to Chapman and Pratt (1961). The photosynthetic pigments (chlorophyll A and B) were estimated by spectrophotometeric method recommended by Metzner *et al* (1965). Results were statistically analyzed by the least significant differences of Snedecor and Cochran (1980). Correlation Coefficient between dry matter yield and plant height, leaf area, protein, fiber, ash, RGR, chlorophyll a, chlorophyll b, Zn uptake, Fe uptake and Mn uptake.

RESULTS AND DISCUSSION

Morphological characters and yield :

Data of morphological characters and yield for the individual cuttings as well as seasonal yield are presented in table (1). Plant height and seasonal fresh fodder yield were significantly increased of all cuts by increasing the rate of Zn, Mn and Fe of 0.4 g/kg seed. Leaf area, dry fodder and seasonal dry fodder yield of the three cuts were significantly increased by increasing rate of Zn and Fe to 0.4 g/kg seed. Fresh fodder was significantly increased by increasing rate of Zn, Mn and Fe to 0.4 g/kg seed of the first and second cut while the fresh fodder in the third cut increased by increasing rate of Zn and Fe only. Increasing plant height by increasing micronutrients may be attributed to increment in internodes length that results from the increment of protoplasm to cell wall material proportion and consequently an increment of cell size that manifested in internode elongation. The increases in these characters due to the application of trace elements may be attributed to that these elements enable the plant to grow well and improve transferring the photosynthetic substances from leaves to the plant. These results are in harmony with those obtained by Manohar *et al* (1992) and Keshwa and Jat (1992).

Chemical analysis :

The results presented in table (2) show the effect of seed coating with microelements on the chemical analysis of the three cuts over two growing seasons (1998 and 1999). There were a significant increment in the percentage of the crude protein and ash in the tissue of pearl millet plant of the three cuts which produced by increasing rates of Zn, Mn and Fe up to 0.4 g/kg seed. The lowest crude fiber percentage of the three cuts was obtained from Zn 0.4 g/kg seed treatment but the un-fertilized plant had the highest crude fiber percentage. Similar results were obtained by Keshwa and Jat (1992).

Physcicological characters :

Results obtained regarding the effect of seed coating with microelements on physcicological characters as detected from combined analysis of two growing seasons (1998 and 1999) are presented in table (3). There was a significant increment in relative growth rate of the three cuts by increasing rate of Zn and Fe up to 0.4 g/kg seed. Seed coating by Zn, Mn and Fe at rate 0.4 g/kg seed caused significant increase in chlorophyll A and B of all cuts. There was significant increase in Zinc uptake of the three cuts by

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using seed coating with Zn up to 0.4 g/kg seed. Data in table (3) indicate that using seed coating by manganese at rate 0.4 g/kg seed caused significant increment in the manganese uptake by plant. Table (3) show that iron uptake of the three cuts was significantly increased by micronutrient seed coating with Fe at rate 0.4 g/kg seed. Increasing Zn, Mn and Fe uptake by micronutrients application method may be attributed to the increment in dry weigh of plant. Roy *et al* (1981) reported that associated role of Zn in protein synthesis is an apparent role in the activity of tryptophan synthesis, and the small amount of iron thus applied in the immediate vicinity of seed is effective in correcting the iron deficiency. They added that plants might further modify the environment in the immediate vicinity of the root by both excreting chemically active substances and absorbing. Root exudate include such materials as organic acid, amino acids, bicarbonate and hydrogen. These compound or ions may increase the availability of zinc, iron and other metals in the immediate vicinity of the roots by providing a chelating effect that improves zinc and iron solubility and a viability. Follett *et al* (1981) mentioned that manganese is known to be a component of two enzyme system, argenase and phospho transferase. It is known to substitute for magnesium in many of the ATP dependent enzyme, of glycolysis. Manganese also has a role in production of the chlorophyll's. These findings are similar to those of Kumar *et al* (1986), Osman *et al* (1991) and Poongothai *et al* (1997).

Interrelation ship between different traits:

Results of simple correlation coefficients between dry forage yield and the other growth forage yield and quality characters are illustrated in Fig. (1 and 2). It is interesting to note that the dry forage yield/fed showed positive and highly significant relation with all other characters expect crude fiber percentage.

REFERENCES

A.O.A.C. (1980). Official Methods of Analysis of the Associate of Official Analytical Chemists. 12th Ed. Washington, D.C.

Ashoub, M.A.; A.M. Esmail; A.O. Osman and A.S. Osman (1998). Effect of some microelements application methods under irrigation regime on growth and yield of maize. Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 6 (1): 183-192.

Attia, S.A.M.; A.M. El-Saadani; A.O.M. Osman and S. Ghaly (1992). Oil seed rap Brassica napus (L.) as affected by K.P.S and different micronutrients in sandy soil. Zagazig J. Agric. Res.,19 (58): 2371-2377.

Belavanaki, L.N.; T.G. Bhadrapur and H.T. Channel (1990). Direct and residual effect of micronutrients on sorghum and succeeding maize crop. Farming System, 6 (1): 32-35.

Chapman, H.D. and P.E. Pratt (1961). Methods of analysis for soil, plant and water. Division of Agric. Sci. Univ of California, USA.

Folet, R.H.; L.S. Murphy and R.L. Douahue (1981). Fertilizers and soil amendments "Micronutrients" Chapter (6): 215-301 by Pointic Hall, Inc. England Wood Cliffs. New Jersey.

Keshwa, G.L. and P.C. Jat (1992). Effect of phosphorus and zinc on quality and fodder production of summer pearl millet. Indian J. of Agric., 37 (1): 187-188.

Kumar, V.; V.S. Ahlawat; R.S. Antil and D.S. Yadav (1986). Interactions of nitrogen and Zinc in pearl millet. Soil Sci., 142 (6), 340-345.

Manohar, S.S.; G.D. Singh and P.S. Rathore (1992). Response of fodder pearl millet to levels of nitrogen, phosphorus and zinc. Indian J. of Agric., 37 (2), 362-364.

Metzner, H.; H. Rau and H. Singer (1965). Unter suchungenzur synchronisierbarkeit einzelmer Pigment ten an density Mutanten Von chlorella Plant 65, 180.

Osman, A.O.; M. Hegazy and S. Ghaly (1991). The effect of seed coating with certain micronutrients on the yield of faba been. Egypt. J. Agric. Res., 69 (2): 351-357.

Poongothai, S.; K.K. Mathan and R. Krishnawany (1997). Effect of zinc and cadmium on the dry matter yield and nutrient uptake of sorghum. Madras Agric. J., 84 (5): 290-293.

Raj, M.E.; B.K. Patel and P.C. Patel (1989). Effect of zinc on yield and nutrient content of summer forage sorghum. Agric. Res. J., 14(2): 79-81.

Roy, H.F.; S. Larry and L. Roy (1981). Fertilizer and soil amendments “Micronutrients” chapter (6): 215-301 by pointic Hall, Inc. England wood cliffs, New Jersey.

Snedecor, G.W. and Cochran, W.G. (1980). Statistical Methods. Iowa State Univ. Press, USA.

Yadav, J.P.; G.D. Singh and G.L. Keshwa (1989). Effect of different forms of nitrogenous fertilizers and levels of zinc on nutrient uptake and yield of pearl millet. Indian J. of Agronomy, 34 (4): 428-430.

تأثير تغليف البذور بالعناصر الصغرى على كمية المحصول وجودته فى نبات الدخن

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أقيمت تجربتان حقليتان بمحطة التجارب الزراعية بالجيزة التابعة لمركز البحوث الزراعية خلال الموسمين الزراعيين الصيفيين ١٩٩٨ ، ١٩٩٩ لدراسة تأثير تغليف البذور العناصر الصغرى (الحديد ، الزنك ، المنجنيز) بمعدلات ٠,٢جم/كجم بذرة، ٠,٤جم/كجم بذرة مع وجود معاملة كونترول بدون إضافة عناصر صغرى وذلك بتغليف كل عنصر منفرد على نمو ومحصول العلف وجودته فى صنف الدخن (شندويل - ١) واستخدم لذلك تصميم القطاعات الكاملة العشوائية فى أربعة مكررات.

وقد أظهرت النتائج زيادة معنوية فى كل من ارتفاع النبات ومحصول العلف الأخضر الكلى ومحتوى العلف من البروتين الخام والألياف الخام والكلوروفيلات أ ، ب بتغليف البذور بالحديد والزنك والمنجنيز بمعدل ٠,٤جم/كجم بذرة وذلك فى الحشات الثلاثة.

كما أدى استخدام تغليف البذور بعنصرى الزنك والحديد بمعدل ٠,٤جم/كجم بذرة إلى زيادة معنوية فى وزن المحصول الجاف ومحصول العلف الجاف الكلى ومساحة الورقة وذلك فى الحشات الثلاثة.

لوحظ أيضاً أن أعلى زيادة فى ارتفاع النبات ومساحة الورقة ومحصول العلف الأخضر والجاف ومحتوى العلف من البروتين الخام والألياف الخام والكلوروفيلات أ ، ب والزنك الممتص كانت نتيجة استخدام الزنك بمعدل ٠,٤جم/كجم بذرة وذلك فى جميع الحشات.

وهنا أظهرت النتائج أن محصول المادة الجافة أعطى ارتباط موجب وعالى المعنوية مع كل الصفات المدروسة فيما عدا معدل الألياف الخام.

Table (1): Morphological characters and yield of pearl millet as affected by seed coating with microelements over two growing seasons (combined analysis of 1998 and 1999).

Treatments	First cut				Second cut				Third cut				Seasonal yield	
	Plant height cm	Leaf area cm^2	Fresh fodder t/fed	Dry fodder t/fed	Plant height cm	Leaf area cm^2	Fresh fodder t/fed	Dry fodder t/fed	Plant height cm	Leaf area cm^2	Fresh fodder t/fed	Dry fodder t/fed	Fresh fodder t/fed	Dry fodder t/fed
Control	126.6	234.8	11.63	1.73	107.9	202.4	8.32	1.55	96.6	151.0	5.68	1.13	25.63	4.41
Zn 0.2 g/kg	131.5	243.1	14.23	1.90	112.1	208.4	10.21	1.79	101.3	163.8	6.10	1.41	30.54	5.10
0.4 g/kg	135.4	256.0	15.95	2.28	115.6	221.3	11.78	2.25	104.8	177.2	7.14	1.93	34.87	6.46
Mn 0.2 g/kg	130.6	238.5	13.33	1.76	111.6	206.1	9.57	1.67	100.4	157.9	5.91	1.24	28.81	4.67
0.4 g/kg	133.8	244.4	15.28	1.97	113.1	214.0	10.86	1.94	103.0	166.4	6.35	1.53	32.49	5.44
Fe 0.2 g/kg	131.1	241.1	13.88	1.82	111.7	207.9	9.90	1.71	100.9	161.3	6.03	1.33	29.81	4.86
0.4 g/kg	134.2	250.5	15.64	2.14	114.1	218.6	11.35	2.07	104.1	173.1	6.91	1.80	33.90	6.01
L.S.D. 0.05	5.18	12.67	2.64	0.31	4.26	12.17	2.00	0.40	4.87	15.61	0.77	0.46	5.52	1.17

Table (2): Chemical analysis of pearl millet as affected by seed coating with microelements over two growing seasons (Combined analysis of 1998 and 1999).

Treatments	First cut			Second cut			Third cut		
	Crude Protein %	Crude Fiber %	Ash %	Crude Protein %	Crude Fiber %	Ash %	Crude Protein %	Crude fiber %	Ash %
Control	13.05	32.44	12.11	11.97	32.75	11.81	9.65	33.90	10.46
Zn 0.2 g/kg	15.05	27.95	13.24	13.96	30.03	12.96	12.22	31.31	11.77
0.4 g/kg	17.00	25.26	14.79	15.71	27.91	14.74	14.23	29.54	13.33
Mn 0.2 g/kg	13.45	29.05	12.64	13.17	30.73	12.52	11.58	31.92	11.28
0.4 g/kg	15.62	26.05	14.02	14.40	28.87	13.57	12.87	29.93	12.14
Fe 0.2 g/kg	14.51	28.40	12.81	13.49	30.33	12.57	11.73	31.68	11.48
0.4 g/kg	16.06	26.35	14.30	14.92	28.33	14.08	13.48	29.72	12.63
L.S.D 0.0 5	2.44	4.22	1.65	2.10	2.89	1.71	2.62	2.75	1.63

Table (3): Physicological characters of pearl millet as affected by seed coating with microelements over two growing seasons (combined analysis of 1998 and 1999).

Treatments	First cut						Second cut						Third cut					
	Relative growth rate	Chlorophyll mg/g		Uptake of mg/plant			Relative growth rate	Chlorophyll mg/g		Uptake of mg/plant			Relative growth rate	Chlorophyll mg/g		Uptake of mg/plant		
	g/g/week	A	B	Zn	Fe	Mn	g/g/week	A	B	Zn	Fe	Mn	g/g/week	A	B	Zn	Fe	Mn
Control	0.11	0.88	0.34	5.12	37.68	3.33	0.10	0.83	0.30	4.18	30.15	2.65	0.08	0.78	0.24	3.02	19.39	1.65
Zn 0.2 g/kg	0.12	1.03	0.42	9.17	50.98	4.17	0.11	0.98	0.37	8.25	42.83	3.49	0.10	0.89	0.30	6.21	28.40	2.21
0.4 g/kg	0.14	1.21	0.59	15.38	71.59	6.49	0.13	1.15	0.52	14.10	61.44	5.55	0.12	1.00	0.43	10.76	42.04	3.64
Mn 0.2 g/kg	0.11	0.98	0.39	5.81	42.77	8.82	0.11	0.93	0.34	4.77	35.08	7.89	0.09	0.84	0.28	3.47	22.91	5.24
0.4 g/kg	0.13	1.12	0.54	7.58	59.01	12.62	0.12	1.04	0.49	6.51	50.75	11.02	0.11	0.94	0.40	4.82	34.16	7.44
Fe 0.2 g/kg	0.12	1.02	0.41	6.55	75.59	3.84	0.11	0.97	0.35	5.50	66.79	3.13	0.09	0.88	0.29	4.03	46.04	1.95
0.4 g/kg	0.14	1.17	0.56	8.03	94.53	5.36	0.12	1.13	0.50	7.06	85.34	4.58	0.12	0.98	0.41	5.27	59.73	2.95
L.S.D. 0.05	0.02	0.18	0.17	5.28	30.83	5.37	0.01	0.18	0.16	5.39	29.58	4.75	0.03	0.13	0.13	3.99	21.16	3.13