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Effect of Foliar Spraying with Dolfan and Zinc on Yield and Yield Components of Maize (*Zea mays*, L.) Under Different Nitrogen Fertilizer Rates

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ABSTRACT

Two field experiments were carried out at El-Fayoum governorate during 2010 and 2011 seasons to study the effect of eight foliar spraying (i.e. without, 500, 1000, 1500cm Dolfan, (D.), without or with1% zinc under four rates of N (0, 40,80 and 120 kg/fad.). and their interaction on yield and yield components of (single cross. 10) maize variety. Results indicated that the difference between foliar spraying treatments were significant for leaf area index, plant height, ear weight, ear grain weight, shelling %, grain yield per fad., harvest index, protein% and carbohydrate% in the two seasons. Foliar maize plants with 1500 cm D +1%Zn or 1000cm D +1% Zn gave the highest values of most studied attributes. Also, results indicated that the differences between N rates for all studied traits in the two seasons. Nitrogen at 120kg/fad. gave the maximum values for most studied traits. The interaction between foliar treatments and N rates were significant for all studied attributes in the two seasons. Also, results show that, foliar maize plants by 1000cm D. or 1500cm D. +1% Zn and fertilized by 120kg N/fad. increased the yield and yield component under experiment soil condition.

Key words: Maize, nitrogen fertilizers, amino acids foliar, foliar of zinc.

Introduction

Attainment of maximum yield of maize and improving its yield is greatly dependent upon appropriate use of mineral N rates to avoid adverse effects and losses of N, air pollution caused by extensive use of mineral N fertilizer. Increasing and improving the yield of maize has been achieved by the appropriate use of mineral N rate. Dolfan, consists 16 free amino acids as shown in Table 1. It improves the plant tolerance to stress or adverse conditions i.e. high temperature, drought and salinity. Some amino acids play an important role in permitting the plant to set and retain more grains. Some amino acids play an important role in synthesis of some hormones i.e. auxins. Amino acids play an important role in photosynthesis by increasing chlorophyll concentration. Also, amino acids act as chelating factor which help in transport and absorption of micronutrients. Zinc is important element to activate most enzymatic reaction into plant cells, metabolism enzymes of Co_2, fractose 1-6-biphosphate, carbonic anhydrates, which, encouragement on decomposition carbonic acid to Co_2 , and H_2O. Also, dehydrogenises enzymes. Zinc is essential to formed tryptophan amino acid, which act on transmission this amino acid to auxin, with addition to activate of enzymes lactic acid dehydrogenates, alcohol dehydrogenises and glutamic acid dehydrogenates. Zinc play an important role in formed proteins where, Starck (2007) found that the increase in photosynthetic pigment perhaps was due to the role of amino acids on metabolism instigation and metabolically processes to increase plant efficiency of wheat. Astaneh and colleagues (2009) indicated that amino acids foliar led to increase the growth and promotion of biosynthesis in the plant and it leads to qualitative and quantitative of herbal products of maize. Ibrahim *et al.* (2009) indicated that application of arginine significantly increased yield and yield components of cotton. Yousef and khbiri (2012) found that spraying wheat plants with aminoforte with 1000 cm/ha. under drought conditions tended to increase leaf chlorophyll content and yield traits. Ammar *et al.*(2013) studied effects of amino acid fertilizers spraying on some physiological and yield traits of wheat under normal and salinity stress, showed significantly increased in the chlorophyll amount of leaves, physiological parameters and yield traits under these conditions. Przemyslaw and Frackowiak (2008) found that Zn foliar application with 1.5 kg/ha. at the 3-4 leaf stage increased the yield and yield components compared with control of maize. Potarzycki and Grzebiaz (2009) showed that plants maize fertilized with 1.0 or 1.5kg Zn/ha. foliar spray significantly increased grain yield with 17.8% as compared by control. Also, Salem and EL-Gizawy (2012) found that foliar spray maize plants with 85 mg/L. Zn, Fe and Mn after 40 days from sowing gave the highest values for yield and yield components under clay soil condition. Farhan *et al*. (2013) show that foliar applied zinc with 180 g /ha. after 15 days of crop emergence increased 100-grain weight, number of grains per ear, ear grain weight, biological yield, grain yield, protein content and oil % compared with the control of maize. Velose *et al*. (2009) showed that application of 200kgN/ha. in wet land soil increase the total N content in leaves and grain, also, caused linear increment in leaf area index of the maize. Mesbah (2011) indicated that application of 120 kgN/fad.in four equal splits in new reclaimed sand soils gave the maximum values for leaf area index, yield and yield components of maize. Bukvie *et al*. (2003) indicated that fertilization maize plants with 183kg P / ha. and 5 or 10 kg Zn /ha.

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foliar application increased the yield and yield components.El- Gabiery and Mesbah (2010) found that, fertilization cotton plants with 30kg N/fad. and sprayed with 2g/L aminototal increased the yield and yield components under clay loam soil conditions. Abbas *et al*. (2012) indicated that application of 230 kg N/ha and 5 L amino acids/ha. significantly increased growth and yield of maize.

Consequently these the study aimed to investigate the effect of N as well as foliar spraying with Dolfan and zinc on yield and yield components of maize under different nitrogen fertilizer rates.

Material and Methods

Field experiments were carried out at El-Fayoum governorate during 2010 and 2011 seasons to study the effect of foliar sprays of Dolfan and zinc under different nitrogen fertilizer rates and their interaction on yield and yield components of maize (*Zea mays*, L.) single cross 10.

A split plot design with 3 replicates was used.

A-The main plots were devoted to the mineral N rates of:
Al- without addition, (control).
A2- low rate (40 kg N/fad.).
A3-medium rate (80 kg N/fad.).
A4- (120 kg N/fad) recommended rate.
B- The sub-plots contained the Dolfan and zinc treatments of:
B1-control (untreated), zero.
B2 -500 cm Dolfan.
B3-1000 cm Dolfan.
B4 - 1500cm Dolfan
B5- 1%zinc.
B6- 500cm D. +1% zinc.
B7- 1000cm D. +1%zinc.
B8- 1500cm D. +1%zinc.
Chemical contents of Dolfan are presented in Table 1.

Table 1: Chemical contents of Dolfan.

Chemical content	Mg/100g	Chemical content	Mg/100g
Threonine	1.79	Iso Leucine	1.11
Aspartic	3.02	Leucine	1.28
Serine	3.81	Tyrosine	0.45
Glutamic	6.92	Phenylalamine	1.29
Proline	3.52	Histiddine	0.32
Glycine	2.80	Lysine	2.81
Alanine	2.34	Arginine	2.41
Valine	2.32	Cystine	1.87

The treatments of Dolfan and zinc were applied as foliar sprays on maize plants at 30 and 45 days from sowing using hand operated sprayer compressed at a low volume of 200 liter of water/fad. Nitrogen fertilizer rates was applied as ammonium nitrate (33.5%N) in two splits, 2/3 rate after thinning (21 days after planting, one plant /hill) and 1/3 rate before the following irrigation in both seasons. Phosphorus fertilizer was added at the rate of 22.5 kg P_20_5/fad. as calcium superphosphate (15.5% P_20_5) during land preparation. Potassium fertilizer was soil added at the rate of 24 kg K_20/fad. as potassium sulphate (48%K_20) in one does with 1st does of nitrogen fertilizer. The plot size was 10.5 m^2 with 5 ridges of 60 cm wide and 3.5m long with hill 25 cm apart. Sowing date was 21 April and preceding crop was Egyptian clover in the two seasons. All other cultural practices were followed as recommended in maize fields.

Table 2: Mechanical and chemical analysis of experimental soil in 2010 and 2011 seasons.

Mechanical analysis	2010 season	2011 season
Sand %	21.90	20.30
Silt %	39.5	38.70
Clay %	38..6	41.00
Texture	Clay loam	Clay loam
Chemical analysis		
PH	8.14	8.03
EC. m. mohs/cm	2.50	2.47
CaCo3%	7.2	6.7
Available N(ppm)	33	30
Available Zn (ppm)	.097	.088

Soil analysis for two seasons was carried out according to Jackson (1973). The results of analysis is shown in Table 2.

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Studied Attributes:

Leaf area index at 60 days after sowing was calculated by the following formula:

$$\text{Leaf area index (LAI)} = \frac{\text{Leaf area per plant}}{\text{Ground area per plant}}$$

Leaf area per plant (cm^2) = length X maximum width X 0.75). Watson 1952

At harvest ten individual plants were taken at random from each subplot to record the experimental data, while, grain yield /fad. were taken from whole plot.

Plant height, in cm.

Ear weight, in g.

Ear grain weight, in g.

Shelling percentage (%)

Grain yield/fad. in Ardab, (one Ardab= 140kg)

Harvest index (HI) computed as: $HI = \frac{\text{Grain yield}}{\text{Biological yield}} \times 100$

protein percentage (%). Lowery *et al.,* (1951)

Carbohydrate percentage (%) Dubois *et al.,* (1956)

Statistical Analysis:

The obtained data of plant parameters was statistically analyzed according to the methods suggested by Gomez and Gomez (1983). Means obtained were compared by using the L.S.D values at 5% level of significance.

Results and Discussion

Leaf Area Index:

Results presented in Table 3 indicate that the differences between N rates for leaf area index were significant.

The highest values were obtained from the high N rate (120kg/fad.) followed by the medium rate (80kgN/fad.), while, the lowest values were obtained from the low N rate (40kgN/fad.) then without application N (zero) in the two seasons. Positive effect of nitrogen treatment on leaf area index may be due to the nitrogen essential role in many physiological processes in maize, as build maize tissue by being included in the representation of protoplast protein and chlorophyll which is necessary to create enzymes and vitamins, increase the size of maize plant, growth of roots and after absorption by the maize in the form of nitrate ion (No_3), reduced to nitrite (No_2) and alfa keto acid which in turn becomes different amino acids. These results are in agreement with Velose *et al*. (2009) and Mesbah (2011).

Also, results indicated that differences between foliar spraying treatments for leaf area index were significant in the two seasons. The highest values were obtained from 1500cm D.+1.0% zinc concentration, followed by 1000cm D.+1.0% zinc concentration in both seasons, while, the lowest value was obtained from the control. Positive effect of foliar treatments (amino acid and zinc) on leaf area index may be due to the high concentration of Dolfan may be due to the increase in auxins of plants, which, have a role in cell division and cell expansion, also, this increase in leaf area index may be due to that amino acids act as chelating factor, which, help in transport and absorption of micronutrients i.e. Zn which involved in the synthesis of indol acetic acid, which, play an important role in plant growth, as well as, zinc is important element to activate most enzymatic reaction into pant cells, such, metabolism, enzymes Co_2 fixation, fructose 1-6 biphosphate carbonic anhydrase, which, encouragement on decomposition carbonic acid to Co_2 and H_2o, also, dehydrogenises enzymes. With addition to, zinc role in formed tryptophan amino acid, which act on transmission to auxin . in this concern Strack (2007), Potarazycki and Grzebiaz (2009), Abbas *et. al*, (2012) and Ammar *et. al*. (2013) showed the same results.

The interaction between nitrogen fertilizer rates and foliar spraying treatments was significant effect on leaf area index in the two seasons. The maximum values for trait was obtained from 120 kg N/fad. and 1500cm D. +1% Zn in the two seasons. On the other hand, the minimum values were obtained from the control (without application of N fertilizer or foliar treatments) in the both seasons.

Table 3: Effect of nitrogen and some foliar treatments on Leaf area index, plant height (cm) and ear weight (gm) of maize in 2010 and 2011 seasons.

Foliar Treatments (F)	2010					2011				
	Nitrogen Kg /fad. (N)				Mean	Nitrogen Kg /fad. (N)				Mean
	0	40	80	120		0	40	80	120	
Leaf area index,										
Control	5.2	6.8	7.3	7.5	6.7	5.2	6.8	7.4	7.5	6.7
500 cm D	5.2	6.9	7.5	7.6	6.8	5.4	6.9	7.5	7.6	6.9
1000 cm D	5.4	7.3	8.0	8.4	7.3	5.4	7.2	8.0	8..2	7.2
1500 cm D	5.6	7.6	8.2	8.7	7.5	5.7	7.3	8.2	8.5	7.4
1% zinc	5.4	6.5	7.4	8.0	6.8	5.2	6.5	7.4	7.9	6.7
500 D +1%Zn	6.0	7.0	8.0	8.8	7.4	5.9	7.3	8.0	8.7	7.5
1000 D +1%Zn	6.5	7.4	8.6	8.9	7.8	6.5	7.4	8.5	9.1	7.8
1500 D +1%Zn	6.6	7.4	8.8	9.1	8.0	6.6	7.4	8.6	9.1	7.9
Mean	5.7	7.1	8.0	8.4	7.3	5.7	7.1	7.9	8.3	7.3
L . S .D. at 5% Level :	(N)0.09		(F)0.12		(NXF) 0.25	(N) 0.07		(F)0.09		(NXF)0.18
Plant height (cm)										
Control	141.6	164.8	179.3	198.2	170.9	143.2	165.2	179.2	196.7	171.1
500 cm D	143.9	171.6	185.4	215.4	179.0	145.2	169.8	185.2	214.5	178.7
1000 cm D	145.6	175.4	192.6	222.6	184.0	146.2	175.0	189.5	223.2	183.5
1500 cm D	150.3	182.1	196.1	247.6	194.0	150.9	182.3	197.5	245.6	194.1
1% zinc	142.7	174.0	183.2	231.4	182.8	144.9	174.0	183.0	231.6	183.4
500 D +1%Zn	145.4	188.2	227.4	255.6	204.1	145.9	186.2	221.1	253.6	201.7
1000 D +1%Zn	158.4	192.8	238.4	265.2	213.7	155.9	193.6	237.8	265.8	213.3
1500 D +1%Zn	161.5	195.3	211.8	274.7	210.0	162.0	196.9	244.2	273.9	219.2
Mean	148.6	180.5	201.7	238.8	192.4	149.3	180.4	204.7	238.1	193.1
L . S .D. at 5% Level :	(N)7.26		(F)8.310		(NXF) 6.62	(N) 1.037		(F)1.656		(NXF) 3.312
Ear weight (gm)										
Control	62.3	106.0	139.6	160.0	117.0	64.6	105.3	138.6	160.0	117.1
500 cm D	66.0	109.0	147.0	164.0	121.5	63.6	108.6	143.3	163.0	119.6
1000 cm D	70.6	111.6	150.3	165.6	124.5	67.3	113.3	143.6	165.6	122.5
1500 cm D	72.6	113.6	149.6	175.6	127.9	74.6	115.0	146.3	167.6	125.9
1% zinc	67.0	104.0	138.6	157.0	116.6	66.6	110.0	137.3	162.6	119.1
500 D +1%Zn	78.6	113.3	154.0	166.3	128.0	78.0	115.3	149.0	170.6	128.2
1000 D +1%Zn	83.6	115.6	162.0	174.0	133.8	84.3	116.3	156.3	175.0	133.0
1500 D +1%Zn	85.0	116.6	168.6	177.6	137.0	86.3	118.0	169.3	179.6	138.3
Mean	73.2	111.2	151.2	167.5	125.8	73.2	112.7	148.0	168.0	125.5
L . S .D. at 5% Level:	(N) 47		(F) 2.212		(NXF) 4.42	(N) 1.524		(F)1.457		(NXF)2.919

Yield and Yield Components Attributes:

Results in Tables 3, 4 and 5 show that the differences between nitrogen fertilizer rates for plant height, ear weight, ear grain weight, shelling % gain yield per fad., harvest index, protein % and carbohydrate % were significant in the two seasons. The highest values were obtained from 120kg N/fad. rate for most studied traits in the two seasons, while, the lowest values were obtained from the control treatment (without application of nitrogen) in the both seasons. Positive effect of the high rate of nitrogen on these traits may be due to the nitrogen essential role in many physiological processes in maize, as build maize tissue by being included in the representation of protoplast protein and chlorophyll, which is necessary to create enzymes and vitamins, increase the size of maize plant, growth of roots and after absorption by the maize in the form of nitrate ion (No_3), reduced to nitrite (No_2) and alfa keto acid which, in turn becomes different amino acid. These results are in agreement with Mesbah (2011) and Abbas *et al*. (2012).

Foliar treatments gave a significant effect on all studied traits in the two seasons (Tables 3,4 and 5). The maximum values for plant height, ear weight, ear grain weight, shelling %, grain yield per fed. Harvest index, protein % and carbohydrate % were obtained from foliar spraying with 1500cm D. +1.0% Zn or 1000cm D. +1.0% Zn for all studied traits in the two seasons. On the other hand, the minimum values were obtained from the control treatment. These results may be due to amino acids important role in synthesis of some hormones i.e. auxins, photosynthesis, especially increasing chlorophyll concentration, also, as chelating factor help in transport and absorption of micronutrients, as well as, zinc role in activate most enzymes Co2 fixation, dehydrogenises enzymes, formed tryptophane amino acids, which acts on transmission these amino acids to auxin. With addition to, activate of enzymes lactic acid and glutamic acid dehydrogenises, which play an important role in formed proteins. These results are in agreement with Astaneh and Colleagues (2009). Potarzycki and Grzebiaz (2009), Abbas *el al.* (2012), Ammar *et al*. (2013) and Farhan *et al*. (2013).

The interaction between nitrogen fertilizer rates and foliar treatment gave significant effect on all studied traits in the two seasons. The maximum values for plant height, ear weight, ear grain weight, shelling %, grain yield per fad, harvest index, protein % and carbohydrate % were obtained from 120 kgN/fad. rate and 1500 D+1.0%Zn for most studied traits in the two seasons. The minimum values for these traits were obtained from the control treatment (without application nitrogen fertilizer or foliar treatment) except control in carbohydrate %. It could be concluded that the best treatment obtained from these study was maize plants fertilized with 120kgN/fad. rate and foliar spraying with 1500cm D.+1.0%zn or 1000cm D. + 1.0%zn under experiment soil condition.

Table 4: Effect of nitrogen and some foliar treatments on ear grain weight (gm), shelling % and grain yield/ fad. of corn in 2010 and 2011 seasons.

Foliar Treatments (F)	2010					2011				
	Nitrogen (N) Kg /fad				Mean	Nitrogen (N) Kg /fad				Mean
	0	40	80	120		0	40	80	120	
Ear grain weight (gm)										
Control	33.0	50.3	81.0	110.6	68.7	33.6	51.3	82.3	108.6	69.0
500 cm D	37.6	55.0	88.0	111.0	72.9	36.0	57.0	86.0	109.3	72.0
1000 cm D	40.6	57.3	91.0	112.6	75.4	39.3	58.0	88.0	115.6	75.2
1500 cm D	43.3	63.3	90.3	113.3	77.5	45.3	62.0	89.6	118.6	78.9
1% zinc	38.6	57.3	87.3	108.0	72.8	35.3	57.3	85.3	111.0	72.2
500 D +1%Zn	45.3	64.6	102.0	119.3	82.8	48.0	65.3	103.6	122.6	84.9
1000 D +1%Zn	48.6	60.3	110.0	130.0	87.2	51.0	72.0	110.0	130.6	90.9
1500 D +1%Zn	53.3	75.0	112.0	130.0	92.5	54.0	76.6	111.6	131.0	93.3
Mean	42.5	60.4	95.2	116.8	78.7	42.8	62.4	94.5	118.4	79.5
L. S .D. at 5% Level :	(N)2.015		(F)2.863		(NXF) 5.725	(N) 1.296		(F) 1.250		(NXF)2.501
Shelling %										
Control	52.9	47.4	58.0	69.1	56.9	52.1	48.7	59.2	67.9	57.0
500 cm D	57.0	50.4	59.8	67.6	58.7	56.5	52.4	60.0	67.0	59.0
1000 cm D	57.8	51.3	60.5	68.0	59.4	58.4	51.1	61.2	69.8	60.1
1500 cm D	58.8	55.7	60.3	64.5	59.8	60.7	53.9	61.2	70.7	61.6
1% zinc	57.1	55.2	62.9	68.7	61.0	53.0	52.1	62.0	68.2	58.8
500 D +1%Zn	58.0	56.9	66.2	71.7	63.2	61.1	56.6	69.2	71.8	64.7
1000 D +1%Zn	58.1	60.8	67.9	74.7	65.4	60.4	61.8	70.3	74.6	66.8
1500 D +1%Zn	62.7	64.2	66.4	74.1	66.9	62.5	64.9	65.9	72.9	66.5
Mean	57.8	55.2	62.7	69.8	61.4	58.1	55.2	63.6	70.4	61.8
L. S .D. at 5% Level :	(N)1.256		(F) 1.623		(NXF) 3.246	(N) 1.061	(F)1.108			(NXF)2.216
Grain yield/ fad. (Ardab)										
Control	5.6	8.6	13.8	18.9	11.7	5.7	8.7	14.1	18.6	11.8
500 cm D	6.4	9.4	15.0	19.0	12.4	6.1	9.7	14.7	18.7	12.3
1000 cm D	6.9	9.8	15.5	19.3	12.9	6.7	9.9	15.0	19.8	12.9
1500 cm D	7.4	10.8	15.4	19.4	13.2	7.7	10.6	15.3	20.3	13.5
1% zinc	6.6	9.8	14.9	18.5	12.4	6.0	9.8	14.6	19.0	12.3
500 D +1%Zn	7.7	11.0	17.4	20.4	14.1	8.1	11.1	17.7	21.0	14.5
1000 D +1%Zn	8.3	12.0	18.8	22.2	15.3	8.7	12.3	18.7	22.3	15.5
1500 D +1%Zn	9.1	12.8	19.1	22.2	15.8	9.2	13.1	19.1	22.4	15.9
Mean	7.2	10.5	16.3	20.0	13.5	7.3	10.7	16.2	20.3	13.6
L. S .D. at 5% Level :	(N)0.256	(F)0.214		(NXF) 0.428		(N) 0.226	(F)0.218		(NXF)0.435	

Table 5: Effect of nitrogen and some foliar treatments on harvest index, protein percentage and carbohydrate percentage of maize in 2010 and 2011 seasons.

Foliar Treatments (f)	2010					2011				
	Nitrogen Kg /fad (N)				Mean	Nitrogen Kg /fad (N)				Mean
	0	40	80	120		0	40	80	120	
Harvest index,										
Control	25.0	26.9	35.1	45.2	33.0	24.9	27.7	36.1	45.3	33.5
500 cm D	28.3	29.0	37.2	44.8	34.8	26.4	30.4	37.8	44.9	34.9
1000 cm D	30.2	29.9	38.2	45.5	35.9	28.0	30.0	38.0	47.3	35.8
1500 cm D	31.2	32.9	37.5	44.9	36.6	31.3	31.9	38.2	48.2	37.4
1% zinc	28.3	30.9	37.0	44.2	35.1	25.2	30.4	37.9	45.7	34.8
500 D +1%Zn	32.0	33.5	41.5	48.0	38.7	32.4	33.5	44.0	49.8	39.9
1000 D +1%Zn	31.8	35.9	44.1	50.8	40.7	33.6	36.8	45.4	52.4	42.0
1500 D +1%Zn	34.7	37.7	44.4	50.4	41.8	33.7	39.2	44.8	51.9	42.4
Mean	30.2	32.1	39.3	46.7	37.1	29.4	32.5	40.3	48.2	37.6
L. S .D. at 5% Level :	(N)0.767		(F)0.639		(NXF) 1.279	(N) 0973		(F)0.728		(NXF)1.456
Protein percentage										
Control	8.2	9.3	10.3	10.4	9.5	8.3	9.4	10.2	10.3	9.5
500 cm D	8.2	9.3	10.3	10.4	9.5	8.3	9.5	10.3	10.4	9.6
1000 cm D	8.6	9.5	10.3	10.6	9.7	8.5	9.5	10.4	10.4	9.7
1500 cm D	8.7	9.5	10.4	10.6	9.8	8.8	9.7	10.4	10.6	9.8
1% zinc	8.4	9.4	10.3	10.4	9.6	8.3	9.3	10.3	10.4	9.5
500 D +1%Zn	8.7	9.8	10.5	10.7	9.9	8.8	9.7	10.6	10.7	9.9
1000 D +1%Zn	8.9	9.9	10.6	10.8	10.0	8.9	9.8	10.6	10.7	10.0
1500 D +1%Zn	8.9	9.9	10.6	10.8	10.0	8.9	9.8	10.7	10.8	10.0
Mean	8.5	9.5	10.4	10.5	9.7	8.6	9.5	10.4	10.5	9.7
L. S .D. at 5% Level :	(N)0.022		(F)0.018		(NXF) 0.035	(N) 0.012		(F)0.014		(NXF)0.029
Carbohydrate percentage										
Control	74.8	73.8	72.7	72.7	73.5	74.9	73.9	72.8	72.8	73.6
500 cm D	74.7	73.7	72.7	72.7	73.4	74.8	73.8	72.8	72.8	73.5
1000 cm D	74.7	73.6	72.5	72.4	73.3	74.8	73.8	72.7	72.6	73.4
1500 cm D	74.6	73.6	72.5	72.6	73.3	74.6	73.6	72.6	72.6	73.3
1% zinc	74.5	73.7	72.7	72.5	73.3	74.5	73.5	72.5	72.4	73.2
500 D +1%Zn	74.4	73.4	72.4	72.3	73.1	74.3	73.3	72.3	72.3	73.0
1000 D +1%Zn	74.2	73.2	72.3	72.2	72.9	74.2	73.2	72.2	72.2	72.9
1500 D +1%Zn	74.2	73.2	72.3	72.2	72.9	74.2	73.2	72.2	72.2	72.9
Mean	74.5	73.5	72.5	72.4	73.2	74.5	73.5	72.5	72.4	73.2
L. S .D. at 5% Level :	(N)0.044		(F)0.052		(NXF) 0.104	(N) 0.014		(F)0.017		(NXF)0.033

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