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Influnce of Integration between Mineral Nitrogen and Humic Acid Fertilizers on Producivity and Nitrogen Partitioning Dynamic in Maize Plants

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TWO FIELD experiments were carried out in Agric. Expt. Farm, Fac. Agric., Ain Shams Univ. at Shalakan, Kalubia Governorate, Egypt during 2013 and 2014 growing seasons. These experiments aimed to study the effect of integrated between mineral nitrogen fertilizer (60, 90 and 120 kg / fad) and Humic acid (0, 15 and 20 kg / fad) on productivity and nitrogen partitioning dynamic of maize plants.

Plants treated with120 kg MN/fad + 20 kg HA and 120 kg MN/fad + 15 kg HA gave the highest values of ear weight (264.9 and 257.4 g), shelling percentage (85.37 and 84.67 %), plant height (284.2 and 279.7 cm), 100 kernel weight (40.20 and 39.09 g),stover yield (9.33 and 9.13 ton/fad) and biological yield (13.10 and 12.66 ton/fad), respectively. Maximum grain yield (3.76 ton/fad) was obtained when plants were fertilized with 120 kg MN. + 20 kg HA.

Results showed that grain nitrogen (%), stover nitrogen (%), biological nitrogen (%), grain nitrogen yield (kg/fad), stover nitrogen yield (kg/fad), total nitrogen yield (kg/fad), GCP % and GCPY (kg/fad) were significantly the highest due to fertilization with 120 kg MN/fad + 20 kg HA/fad. Such potent treatment increased the previous traits than by 1.723%, 0.413%, 2.14%, 64.94 (kg/fad), 38.58 (kg/fad), 103 (kg/fad), 9.82 % and 370.2 (kg/fad), respectively.

Data also cleared that the effect of integration between mineral nitrogen fertilizer and humic acid were significantly differed in NUE, NRE%, NPF and NHI%.

Keywords: Maize; humic, Grain yield, Ear characteristics, Nitrogen physiological parameters

Introduction

Maize is one of the three most important food crops globally devoted to cereal production and generally considered to have a relatively high soil fertility requirement to attain maximum yields (Paponov & Engels, 2003; Uribelarrea et al., 2007 and Peng et al., 2010). Application of N through chemical fertilizers is the dominant and main source of N input in the crop production systems world-wide. Currently, 50% of the human population relies on N fertilizer for food production while about 60% of global N fertilizer is used for producing the world's three major cereals: rice, wheat, and maize (Ladha et al., 2005).

Nitrogen application plays a fundamental role in maximizing maize growth and grain yield. The importance of N for maize growth is closely linked to its role in plant cell in enlargement and photosynthesis. Abd Elattief & Fakkar (2006) found that increasing nitrogen levels from 90 to 120 and 150 kg N/fad significantly increased ear length, ear diameter, number of rows/ear, shelling %, 100-kernel weight and grain yield/fad. Khatun et al. (2012) studied the effect of four nitrogen levels (0, 110, 130 and 150 kg N/ ha) on maize productivity and found that nitrogen levels had pronounced effect on grain yield and its attributes. Results also indicated that 150 kg N/ha gave the highest ear length, number of grains/ear, grain yield, biological yield and harvest index. Dawadi & Sahi (2012) studied the effect of three nitrogen

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levels (120, 160 and 200 kg/ha) on maize plants and found that 200 kg/ha application produced a higher grain yield than 120 kg/ha application.

The beneficial effects of HA on plant growth may be related to their indirect (increase of fertilizer efficiency or reducing soil compaction), or direct (improvement of the overall plant biomass) effects. (Vaughan & Malcom, 1985). Humic acid (HA) increased number of leaves of treated maize plants up to 12 compare with untreated plants . Furthermore, plants treated with HA produced more than one cob per plant. Treated plants exhibited a high proliferation of lateral roots compared to control treatment (Eheraguibel et al., 2008) .

The objectives of this study were to reduce the amount of mineral nitrogen fertilizers added to maize plant by substituting their partial amounts with humic acid to reduce production cost. In addition to the aforementioned target, decrease environment pollutions and increase maize productivity, nitrogen use efficiency and save soil fertility.

Materials and Methods

Two field experiments were carried out in Agric. Expt. Farm, Fac. of Agric., Ain Shams Univ. at Shalakan, Kalubia Governorate, Egypt during 2013 and 2014 growing seasons. These experiments aimed to study the effect of integration between three levels of mineral nitrogen (MN) (60, 90 and 120 kg MN/fad) and three levels of humic acid (H.A) (0, 15 and 20 kg /fad) fertilizers on productivity and nitrogen partitioning dynamic of maize (*Zea maize*) plant. (single cross 10 hybrid was used in both seasons and it is seeds were kindly obtained from Maize Research Department. Field Crop Research Institute (FCRI),. Agricultural Research Center (ARC), Ministry of Agriculture, El-Giza, Egypt).

The experimental unit area was 16.8 m^2 consisting of 6 ridges 0.70 m in width and 4 m length and planted one ridge side at 25 cm apart and one plant per hill. The mineral nitrogen fertilizer was applied as urea (46.5% N). It was added in two portions. The first one (50%) was applied after 21 days from sowing and the second one (50%) was applied after 43 days from sowing. The mineral nitrogen fertilizer was applied just before irrigation in all studied treatments. Humic acid was added before sowing. Other agricultural practices of maize were applied as recommended.

The mechanical and chemical analyses of the experimental soils were estimated according to Black (1965) and Jackson (1967). The data in Table1 indicated that it was clay in texture and its chemical analysis is shown in Table 2.

TABLE 1. Mechanical analysis of experimental soil (%) (average of two seasons of 2013 and 2014).

Depth (cm)	Sand	Silt	Clay	Soil texture
0-30	16	29	55	Clay

TABLE 2. Chemical composition of the experimental soil (mg soluble cations and inions/kg soil) and pH of soil solution at sticky point (average of two seasons of 2013 and 2014).

Depth	Cations				Anions		pH
(cm)	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^-	Cl^-	
0 - 30	55.4	17.8	38.3	12.7	61.3	46.7	8.0

At harvest a samples of plants of each treatment in each of the three replications were taken, and the following data were recorded

Data recorded at harvest

Plant height (cm), ear length (cm), ear diameter (cm), ear weight (g), number (No.) of rows/ear, shelling %,100-kernel weight (g), grain yield (ton/fad), stover yield (ton/fad), biological yield (ton/fad), and Harvest index percentage (HI %) = Grain yield (ton/fad) x 100/Biological yield (ton/fad). Grain, stover and biological yields were estimated on the basis of yield per total plot and then calculated as yields per faddan (ton/fad).

About 50g of grains and in three replications were fine grinded to determine nitrogen (N) percentage using micro-Kjeldahl method according to AOAC (1995). The grain crude protein content (GCPC) was calculated by multiplying total N% by 5.7.

Nitrogen physiological parameters

The accumulated total nitrogen in grains and stover yields were estimated according to AOAC (1995) to calculate nitrogen physiological parameters including.

1- Nitrogen harvest index. (NHI %) = Nitrogen in grain (kg) X100 / Total plant nitrogen

2- Nitrogen use efficiency (NUE), nitrogen physiological efficiency (NPE) and nitrogen recovery efficiency (NRE %) were calculated using the equations of Timsina et al. (2001) as follows:

NUE = Grain yield (kg/fad) / kg N applied/fad

NPE = Grain yield (kg/fad) / kg N absorbed/fad.

NRE % = kg N absorbed × 100 / kg N applied/fad

Economical study

The economic study of the different fertilizers treatments was calculated via three estimates as follows:

1. Total cost of maize production as affected by rates and sources of N fertilizers. The other recommended agricultural practices for growing maize crop were constant for the different treatments, so that they were excluded from the economical evaluation.

2. Total income of maize according to the actual price of grains yield as affected by the above studied treatments.

3. Net return of maize production (net return =total return – total cost) as affected by the above studied treatments.

Statistical analysis

The obtained data were exposed to the proper statistical analysis according to Snedecor & Cochran (1967). The least significant differences (LSR). Using Costat computer program V 6.303 (2004). LSR at 5% level as significance was used to differentiate between means. Data of 2013 and 2014 growing seasons were subjected to homogeneity variance test for running the combined analysis of the data.

Results and Discussion

Ear parameters

Data in Table 3 demonstrated the significant effects of integration between mineral nitrogen (MN) and humic acid (HA) fertilizers on ear weight (g) and shilling percentage (%) meanwhile, there were no-significant effects on either of ear diameter (cm) or rows number/ear traits. Similar finding was obtained by El-Metwally et al. (2001) whom showed that raising nitrogen levels up to 120 kg N/fad caused a considerable increase in all estimated ear traits except for number of rows/ ear. Result also showed that plants treated with 120 kg MN/fad + 20 kg HA and 120 kg MN/fad + 15 kg HA gave the highest values of ear weight by 264.9 and 257.4 (g), respectively followed by 120 kg MN/fad and 90 kg MN/fad. + 20 kg HA/ fad, respectively. On the other hand 60 kg MN/ fad + 15 kg HA/fad and 60 kg MN treatments recorded the lowest values by 168.7 and 160.1 (g), respectively. In addition, the application of 15 and 20 kg HA/fad with mineral nitrogen fertilizer levels (60, 90 and 120 kg/fad)recorded increases in ear weight (g) as compared to the same levels of mineral nitrogen treatments without humic acid by the following percentages 5.4%, 17.2%, 15.1%, 23.2%, 3.9% and 6.9 %, respectively.

In respect to the effect of fertilizers treatments on shelling %, data recorded that maize plants fertilized with either 120 kg MN/fad + 20 kg HA or 120 kg MN/fad + 15 kg HA obtained the highest values of shelling % by 85.37 and 84.67 % followed by 90 kg MN/fad + 20 kg HA and 120 kg MN/fad by 82.83 and 82.40 %, respectively. These data were agreement with Abd Elattief & Fakkar (2006) whom found that increasing nitrogen levels from 90 to 120 and 150 kg N/ fad significantly increased shelling percentage (%). Meanwhile, the lowest values of shelling % (77.07 %) was detected with 60 kg MN/fad, followed by 79.07 % with 60 kg MN/fad +15 kg HA/fad traits.

TABLE 3. Effect of integration between mineral nitrogen and humic acid fertilizers on some ear parameters of maize plants.

Treatments	Ear Weight (g)	Ear diameter (cm)	Rows No. /ear	Shilling %
60 kg MN/fad	160.1 f	4.46 a	12.87 a	77.07 d
60 kg MN/fad + 15 kg HA/fad	168.7 f	4.53 a	13.13 a	79.07 cd
60 kg MN/fad + 20kg HA/fad	187.6 e	4.60 a	13.07 a	80.33 bc
90 kg MN/fad	200.6 d	4.60 a	12.87 a	80.80 bc
90 kg MN/fad + 15 kg HA / fad	230.9 c	4.67 a	12.93 a	81.50 bc
90 kg MN/fad + 20 kg HA /fad	247.2 b	4.73 a	13.00 a	82.83 ab
120 kg MN/fad	247.7 b	4.73 a	12.93 a	82.40 ab
120 kg MN/fad + 15 kg HA/fad	257.4 ab	4.80 a	12.87 a	84.67 a
120 kg MN/fad + 20 kg HA	264.9 a	4.93 a	12.80 a	85.37 a

Yield and its attributes

Data in Table 4 revealed that the effect of integration between mineral nitrogen fertilizer and humic acid was significant differed on plant height,100 kernel weight, grain yield, stover yield, biological yield and HI % traits. The highest value of plant height (284.2 cm) was obtained when plants were fertilized with 120 kg MN. + 20 kg HA. followed by 120 kg MN + 15 kg HA (279.7 cm). Such findings are agreement with results obtained by Abd Elattief & Fakkar (2006) whom found that high level of nitrogen (150 kg/fad) increased significantly plant height. Meanwhile shortest plants (202.1 cm) were recorded when plots were fertilized with 60 kg MN. The highest value of 100 kernel weight (40.20 g) was obtained when plants were fertilized with 120 kg MN + 20 kg HA followed by 120 kg MN + 15 kg HA (39.09 g) and 120 kg MN/fad (38.04 g). Rasheed et al. (2004) showed that 100-kernels weight of maize plants increased with increase the rates of nitrogen fertilizers from 0 to 160 kg N/fad. Meanwhile, the lowest value (36.67 g) was recorded when plants were fertilized with 90 kg MN.

Maximum grain yield (3.76 ton/fad),was obtained when plants were fertilized with 120 kg MN +20 kg HA. These results come in the same line with those of Mohamed (2004) who found that increasing nitrogen level up to 120 kg/fad increased the grain yield of maize, Meanwhile, the lowest value (1.98 ton/fad) was recorded when plants were fertilized with 60 kg MN. Meanwhile, the integration between mineral nitrogen fertilizer 90 kg/fad and humic acid 20 kg/fad gave the highest grain yield value (3.43 ton/fad) and out yielded that of the recommended fertilizer treatment of 120 kg/fad (3.31 ton/fad). Grain yield was increase by a rate of 13.13 and 18.69 % when plants were fertilized with 60 kg MN + 15 kg HA and60 kg MN + 20 kg HA, respectively compared with 60 kg MN only. Application of 90 kg MN + 15 kg HA and 90 kg MN + 20 kg HA cussed increase of grain yield percentage by rate of 13.40% and 24.28%, respectively compared with 90 kg MN only. Meanwhile the integration between mineral and organic fertilizer in 120 kg MN + 15 kg HA and 120 kg MN + 20 kg HA caused increase of grain yield percentage a rate of 6.34% and 13.60%, respectively compared with 120 kg MN only. Hussein et al (2007) studied the effect of various N fertilizer rates on maize yield. They found that adding 38 kg/ha N above the recommended rate (300-338 kg N/ha) increased grain yield by 9%, whereas adding an additional 75 kg N/ha (300-375 kg N/ha) increased grain yield by 22%. Vaughan & Malcom (1985) reported that the beneficial effects of HA on plant growth may be related to their indirect (increase of fertilizer efficiency or reducing soil compaction), or direct (improvement of the overall plant biomass) effects.

Maximum stover yield (9.33 ton/fad) was obtained when maize plants were fertilized with 120 kg MN + 20 kg HA followed by 120 kg MN + 15 kg HA (9.13 ton/fad). Meanwhile, the lowest value of stover yield (7.92 ton/fad) was recorded when plants were fertilized with 60 kg MN.

TABLE 4. Effect of integration between mineral nitrogen and humic acid fertilizers on plant height, 100-kernel weight, yield and harvest index (HI %).

Treatments	Plant height (cm)	100 kernel weight (g)	Yield (ton/fad)			HI %
			Grain	Stover	Biological	
60 kg MN/fad	202.1 e	36.92 bc	1.98 f	7.92 e	10.03 f	21.01 d
60 kg MN/fad + 15 kg HA/fad	229.9 d	37.66 bc	2.24 e	8.25 de	10.48 e	21.34 d
60 kg MN/fad + 20kg HA/fad	237.1 d	37.65 bc	2.35 e	8.46 cd	10.81 e	21.77 d
90 kg MN/fad	238.8 d	36.67 c	2.76 d	8.52 cd	11.28 d	24.48 c
90 kg MN/fad + 15 kg HA / fad	261.6 c	37.72 bc	3.13 c	8.75 bc	11.88 c	26.34 b
90 kg MN/fad + 20 kg HA /fad	273.6 b	38.49 bc	3.43 b	8.83 bc	12.27 bc	27.98 ab
120 kg MN/fad	273.4 b	38.04 abc	3.31 bc	8.81 bc	12.12 c	27.29 ab
120 kg MN/fad + 15 kg HA/ fad	279.7 ab	39.09 ab	3.52 b	9.13 ab	12.66 ab	27.86 ab
120 kg MN/fad + 20 kg HA	284.2 a	40.20 a	3.76 a	9.33 a	13.10 a	28.75 a

The highest value of biological yield (13.10 ton/fad)was obtained when plants were fertilized with 120 kg MN + 20 kg HA. followed by 120 kg MN + 15 kg HA (12.66 ton/fad). Meanwhile, the lowest value (10.03 ton/fad) was recorded when plants were fertilized with 60 kg MN. On the other hand, the maximum harvest index value (28.75%) was obtained when plants were fertilized with 120 kg MN. + 20 kg HA; The effects of increasing nitrogen fertilizer levels on harvest index % of maize plants are recently investigated by Pandey et al. (2000) and Evans et al. (2003), they reported that harvest index of maize plants was increased by increase level of nitrogen fertilizer. Meanwhile, the lowest values (21.01%, 21.34% and 21.77%) were recorded when plants were fertilized with 60 kg MN only, 60 kg MN + 15 kg HA and 60 kg MN + 20 kg HA., respectively. Humic acid (HA) increased number of leaves of treated maize plants up to 12 compare with untreated plants. Furthermore, plants treated with HA produced more than one cob per plant (Eheraguibel et al., (2008)) .

Nitrogen and protein traits

Results in Table 5 showed the significant effects of integration between mineral nitrogen and humic acid fertilizers on nitrogen partitioning, (GCP %) and grain crude protein yield (GCPY kg/fad). Results also showed that grain nitrogen (%), stover nitrogen %, biological nitrogen %, grain nitrogen yield (kg/fad), stover nitrogen yield (kg/fad), total nitrogen yield (kg/fad), GCP % and GCPY (kg/fad) were significantly the highest due to fertilization with 120 kg MN/fad + 20 kg HA/fad by 1.723%, 0.413%, 2.14%, 64.94 (kg/fad), 38.58 (kg/fad), 103 (kg/fad), 9.82 % and 370.2 (kg/fad), respectively compared with those of 60 kg MN/fad treatment. These increases could be attributed to high available mineral nitrogen utilized by maize plant and therefore increase its mobilization from source to sink. On the other hand, the minimum values of all the pervious traits were recorded with 60 kg MN/fad.

At harvest the total nitrogen yield in straw and grains were computed for calculating NUE, NRE%, NPE and NHI%. The data in Table 6 clear that the effect of integration between mineral nitrogen fertilizer and humic acid were significantly differed inNUE, NRE%, NPF and NHI%. Plants were fertilized with 60 kg MN + 20 kg HA; 90 kg MN + 20 kg HA and 60 kg MN + 15 kg HA recorded the highest values of NUE (38.58, 37.72and 36.82kg grains/kg applied N), respectively. Meanwhile the lowest values (27.56and 29.21kg grains/kg applied N) were recorded when plants were fertilized with 120 kg MN only and 120 kg MN + 15 kg HA respectively.

On the other hand, maximum values of NRE% (92.35% and 91.76%)were obtained when plants were fertilized with 60 kg MN + 20 kg HA and 90 kg MN + 20 kg HA, respectively. Meanwhile, the lowest values (69.43% and 71.98%) were recorded when plants were fertilized with 120 kg MN only and 90 kg MN only, respectively. Concerning NPE and NHI, the data in Table 6 showed slight differences between fertilizers treatments to be range between 36.44 to 42.63kg grains/kg absorbed N and 56.77to 64.08%, respectively.

TABLE 5. Effect of integration between mineral nitrogen and humic acid fertilizers on nitrogen partitioning, grain crude protein percentage (gcp %) and grain crude protein yield (gcpy kg/fad).

Treatments	Nitrogen %			Nitrogen yield (kg/fad)			G CP %	GCPY (kg/fad)
	Grain	Stover	Biolo-gical	grain	Stover	total		
60 kg MN/fad	1.347 f	0.257 e	1.60 e	26.71 g	20.36 h	47.08 g	7.68 f	152.3 g
60 kg MN/fad + 15 kg HA/fad	1.367 f	0.267 de	1.63 e	30.56 fg	22.00 gh	52.57 f	7.79 f	174.2 fg
60 kg MN/fad + 20kg HA/fad	1.400 ef	0.277 de	1.67 de	32.95 f	23.38 fg	56.33 f	7.98 ef	187.8 f
90 kg MN/fad	1.453 de	0.290 d	1.74 d	40.12 e	24.66 f	64.78 e	8.28 de	228.7 e
90 kg MN/fad + 15 kg HA / fad	1.527 cd	0.317 c	1.84 c	47.80 d	27.67 e	75.47 d	8.70 cd	272.5 d
90 kg MN/fad + 20 kg HA /fad	1.560 bc	0.340 c	1.90 c	53.47 bc	30.04 d	83.50 c	8.89 bc	304.8 bc
120 kg MN/fad	1.533 c	0.370 b	1.90 c	50.73 cd	32.59 c	83.32 c	8.74 c	289.2 cd
120 kg MN/fad + 15 kg HA/fad	1.630 b	0.397 a	2.03 b	57.48 b	36.26 b	93.75 b	9.29 b	327.6 b
120 kg MN/fad + 20 kg HA	1.723 a	0.413 a	2.14 a	64.94 a	38.58 a	103.52 a	9.82 a	370.2 a

TABLE 6. Effect of integration between mineral nitrogen and humic acid fertilizers on nitrogen physiological parameters.

Treatments	NUE	% NRE	NPE	% NHI
60 kg MN/fad	33.06 cd	78.46 c	42.29 a	56.77 c
60 kg MN/fad + 15 kg HA/fad	36.82 ab	86.53 b	42.57 a	58.19 bc
60 kg MN/fad + 20kg HA/fad	38.58 a	92.35 a	41.80 ab	58.48 bc
90 kg MN/fad	30.67 de	71.98 d	42.63 a	61.92 a
90 kg MN/fad + 15 kg HA / fad	34.49 bc	83.16 b	41.53 ab	63.35 a
90 kg MN/fad + 20 kg HA /fad	37.72 a	91.76 a	41.22 ab	64.08 a
120 kg MN/fad	27.56 f	69.43 d	39.71 bc	60.85 ab
120 kg MN/fad + 15 kg HA/fad	29.21 ef	77.69 c	37.85 cd	61.34 ab
120 kg MN/fad + 20 kg HA	31.13 de	85.56 b	36.44 d	62.75 a

Economic study

Costs of the different agricultural practices were excluded. Other costs, i.e., price of mineral nitrogen and humic acid fertilizers of the studied treatments were included. It is clear from Table 7 that data of net return (total return – total cost) could be arranged in respective descending order as follows: 120 kg MN/fad + 20 kg H.A/fad, 120 kg MN/fad + 15 kg H.A/fad, 90 kg MN/fad + 20 kg H.A/fad, 120 kg MN/fad, 90 kg MN/fad + 15 kg H.A/fad, 90 kg MN/fad, 60 kg MN/fad + 20 kg HA/fad, 60 kg MN/fad +15 kg HA/fad and 60 kg MN/fad. Although maize net return of 120 kg MN/fad + 20 kg AH/fad and 120 kg MN + 15 kg HA surpassed those of 90 kg MN + 20 kg HA/fad by 521 and 92 L.E./fad. ,respectively. There were many advantages that could be achieved by the application of the later treatment for certain reasons, which mainly improved soil physical, chemical and biological traits. These improvements which in turn have promising effect on the next crops. In addition humic acid has a considerable effect on reduction the environmental pollution comparing to applying the conventional mineral fertilizers.

TABLE 7. Total costs, total return and net return (L.E./fad) due to mineral nitrogen and humic acid fertilizers (average of 2013 and 2014 growing seasons).

Treatment	Cost (LE)		Total cost (LE)	Total return (LE)	Net return (LE)
	M N	HA			
60 kgMN/fad	387	-------	387	4250	3863
60 kg MN/fad + 15 kg HA/fad	387	225	612	4793	4181
60 kgMN/fad + 20kg HA/fad	387	300	687	5043	4356
90kg MN/fad	581	-----	581	5915	5334
90 kgMN/fad + 15 kg HA / fad	581	225	806	7608	5902
90 kgMN/fad + 20 kg HA /fad	581	300	881	7358	6477
120 kg MN/fad	774	------	774	7086	6312
120 kg MN/fad + 15 kg HA/fad	774	225	999	7558	6559
120 kg MN/fad + 20 kg HA	774	300	1074	8072	6998

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تاثير التكامل بين التسميد النيتروجيني المعدني و الهيومك اسيد علي الإنتاجية و تجزئة النيتروجين في نباتات الذرة الشاميه

محمد أحمد عبد الهادي،محمد عبد الحميد فرجاني ، محمد محمود إسماعيل التمساح
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أقيمت تجربتان حقليتان فى محطة التجارب الزراعية التابعة لكلية الزراعة جامعة عين شمس – شلقان- محافظة القليوبية خلال موسمى الزراعة 2014 و 2015 لدراسة تأثير التكامل بين ثلاث مستويات من التسميد النيتروجيني المعدني (60 – 90 – 120 كجم ن/ فدان) و ثلاث مستويات من الهيومك اسيد (صفر - 15 – 20 كجم هيومك /فدان) علي الإنتاجية و تجزئة النيتروجين في نباتات الذرة الشامية(هجين فردى 10). وكانت النتائج كالتالي:

سجلت معاملتي التسميد بمعدل 120 كجم ن / فدان + 20 كجم هيومك اسيد و 120 كجم ن / فدان + 15 كجم هيومك اسيد أعلي القيم لكل من الصفات التالية: وزن الكوز (264,9 و 257,4) ، النسبة المئوية للتفريط (85,37 و 84,67 %) ، طول النبات (284,2 و 279,7 سم) ، وزن المائة حبة (40,20 و 39,09 جم) ، وزن محصول القش (9,33 و 9,13 طن/ فدان) و المحصول البيولوجي (13,10 و 12,66 طن/ فدان) علي الترتيب و اعطي التسميد بمعدل 120 كجم ن/فدان + 20 كجم هيومك اسيد أعلي قيمة لمحصول الحبوب (3,76 طن/فدان) بينما سجلت المعاملة بـ 60 كجم ن/فدان اقل قيمة لمحصول الحبوب (1,98 طن /فدان)

أظهرت النتائج ايضا ان التسميد بمعدل 120 كجم ن / فدان + 20 كجم هيومك اسيد أعطي أعلي القيم لكل من النسبة المئوية للنيتروجين في الحبوب (1,723%) ، النسبة المئوية للنيتروجين في القش (0,413 %) ، النسبة المئوية للنيتروجين الكلي (2,14 %) ، محصول النيتروجين في الحبوب (64,94 كجم/فدان) ، محصول النيتروجين في القش (38,58 كجم/فدان) ، محصول النيتروجين الكلي (103 كجم/فدان) ، النسبة المئوية للبروتين في الحبوب (9,82 %) و محصول البروتين في الحبوب (370,2 كجم/فدان) علي الترتيب.

كما اظهرت النتائج وجود تأثير معنوي لمعاملات التسميد بالنيتروجين و الهيومك اسيد علي صفات دليل حصاد النيتروجين (NHI) ، نسبة النيتروجين المستخدم (NUE) ، النيتروجين الفسيولوجي الفعال (NPE) و نسبة النيتروجين المسترد (NRE).