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PRODUCTION EFFICIENCY oF SOME NITROGEN FERTILIZATION and THEIR EFFECT on THE DAMAGE CAUSED BY WILD BIRDS on SUNFLOWER CROP

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ABSTRACT:

A field experiment was carried out at The Experimental Farm, Faculty of Agriculture, Al-Azhar Univ. Assiut, Egypt in order to study the effect of different nitrogen fertilization (bio, organic and chemical) with different combination on sunflower yield and its oil content as well as the damage caused by wild birds. The fertilization treatments were carried out as follow. The first treatment without any fertilization as control. The second was treated with ammonium nitrate as a chemical fertilizer (CN) with rate of 50 Kg/fed the third treatment was the effective microorganisms (EM) with rate 6 L/fed. as a bio-fertilizer.The fourth treatment was treated with humic acid (HA) with a rate of 4 L/fed + EM (EMH). The fifth area was treated with a rate of 20 m^3 fed from the sheep manure (SM) as organic fertilizer. The sixth treatment was a mixed from SM + EM. The last treatment was mixture from SM + EMH. Each treatment was three plots every one was (2 × 4.5m.) and laid out in a randomized block design with three replicates.

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The results indicated that the growth characters (harvest index, seed oil and protein content). The highest values of seed weight/plant and seed or oil yield/fed (131.42g, 1987.12 kg and 641.67 kg, respectively) were recorded in soil treated by sheep manure. The wild birds attacked the sunflower plants in doughy and mature stages till the harvesting time causing a severe damage in plant heads. Wild birds caused a reduction in sunflower yield by 6.50, 6.67 and 7.33% in the control, (SM) and CN or EMH treatments, respectively. The highest losses in sunflower yield were recorded in the soil treated by SM+EMH (11.97%). The study recommends the introduction of treatment fertilizer (SM+EM) where meets the requirements of production efficiency to produce higher and lower costs, and dissemination of such recommendation on farmers sunflower at the level of the Republic.

Key words: Chemical, organic, bio-fertilizer, without fertilizer, loss, birds, technical (productivity) efficiency, Data Envelopes Analysis model (DEA), leaner program, optimal treatments and sunflower.

INTRODUCTION:

Sunflower (*Helianthus annuus*, L.) is one of the most important edible oil crops all over the world. Its seeds contain 24-49 % oil and its cake contains 25-35 % protein, which is mostly feeded to livestock because of its high biological value. Furthermore, sunflower seeds are eaten as salted whole seeds as roasted nut meats. (**Saleh *et al*., 2004 and Aowad and Mohamed, 2009)**.

Organic materials, particularly solid manure, useful amounts of organic matter to soils, act as soil conditioners and structural improvers. Also, they increased the water holding capacity, drought resistance and soil structural stability as well as enhanced

soils biological activity **(Meenakumari and Shekhar 2012).** Bio-fertilizers drew the attention as an alternative way to nitrogen fertilizer application. They have many merits in supplying part of the plant nitrogen requirement that could be reaching to 25 %. They also help in increasing nutrients availability, reduce environmental pollution as a result of mineral fertilizers over use, control the vegetative growth and improve the yield potential (**Ragab, 1999 and Muhammad *et al.*, 2012)**.

The bird damage to crops, particularly cereal grains, is a serious problem allover the world. In African countries, bird damage to cereal crops represents economic losses reached to 5 - 10 % of the production (**Bruggers and Rulle 1981**). In Egypt, some bird species are considered the most important agricultural pest especially in the field crops. Such as house sparrow, *Passer domesticus niloticus* (L.), hooded crow *Corvus corone sardonius* (L.) and palm dove, *Streptopelia senegalensis egyptica* (L.) and other bird species (**Bonnah, 2007 and Omar, 2010**).

The current study aims to assess the influence of adding different nitrogen fertilizer types on sunflower productivity as well as the damage caused by wild birds. Also, estimated the total economic losses due to them practices.

MATERIALS AND METHODS:

An experimental field was conducted at the experimental farm, faculty of agriculture, Al-Azhar University, Assiut, Egypt. Some soil properties were determined according to **Page *et al.*, (1982)** and they are shown Table (1).

Sunflower seeds (Giza 102 cultivar) were sown on July 5th 2011. A seasonal total of 200 kg/fd calcium super phosphate (15.5% P_2O_5) and 50 kg/fd potassium sulphate (48% K_2O) were applied as recommended fertilizer doses.

The other recommended cultural practices for growing sunflower plants were followed.

The experiment design was a randomized complete block with three replicates and included seven nitrogen fertilizer treatments:

1) Control (without N fertilization) (C).

2) Treatment was chemical nitrogen fertilizer (ammonium nitrate, 33.5% N) at a rate of 200 kg / fed was added by three doses and 200 kg / fed calcium super phosphate (15.5% P_2O_5) and 50 kg / fed. potassium sulfate (48% K_2O) was applied as recommended fertilizer doses during soil preparation (CN).

3) Effective microorganisms at a rate of 6 L / fed was mixed with irrigation water (EM).

4) Humic acid (HA) (20 % concentration) at a rate of 4 L / fed. + EM (EMH).

5) Sheep manure at a rate of 20 m^2 / fed was added during soil predation (SM).

6) SM + EM.

7) SM + EMH. A representative soil sample was collected from each plot (2 x 4.5 m.) to 30 cm depth before cultivation and after harvesting.

The soil sample was air dried and sieved to determine some soil properties according to **Jackson (1973).** Also, Sheep manure was chemically analyzed (as shown in table 2) according to **Page *et al.*, (1982).** At harvest stage, heads were picked from 3 randomly selected plants in each experimental unit and air-dried for 3 days then, seeds were manually extracted. The seeds were subjected to estimate seed weight and seed index. Seed yield (ton fed.) was calculated by using all heads of plants remained in all experimental unit.

Oil percentage of seed was determined in the air dried seeds according to the method described by **A. O. A. C. (1995)** Using soxhelt apparatus and petroleum ether (60-80 ^{o}C) as solvent. Protein % of seeds was calculated by multiplying N % × 6.25 according to **(A. O. A. C., 2000)**.

Monitoring of bird losses in the field was based on the frequency encounter of loss head sunflower plants until the harvest time. Samples were token at two dates, after doughy and mature stages. Direct count method was used in order to determine the bird loss. Samples of thirty plants were chosen randomly from each plot and loss seeds were recorded. The attacked plants were estimated as a percentage of the total examined plants. The obtained data were subjected to the analysis of variance LSD at 0.05 was used to differentiate the means according to **Steele and Torrie (1984).**

Table (1): Some soil properties of the studied field.

Parameter	**Value**
Sand (%)	26.00
Silt (%)	37.40
Clay (%)	36.60
Texture grade	Clay Loam (C L)
PH (1:2.5) Susp.	8.08
EC (dSm^{-1}) (1:2.5)	0.298
Cations (cmol /kg soil)	
Ca^{++}	0.84
Mg^{++}	0.43
Na^{+}	0.59

K^{+}	0.28
Anions (cmol /kg soil)	
$CO^{=3}$	0.00
HCO^{-3}	0.56
Cl^{-}	0.89
$SO^{=4}$	0.66
Total–N (%)	0.14
O.M (%)	1.56
$CaCO_3$ %	1.05

Table (2): Chemical analysis of sheep manures

Characteristics	Sheep manure
Total-N %	2.25
Total-P %	1.29
Total-K %	3.56
Organic matter	38.42
PH (1:5) Susp.	8.48
EC dSm^{-1} (1:5)	4.164
C/N	9.92

Data Envelopes Analysis model (DEA):

It requires measurement mode function appropriate for this purpose and their determinates according to **Farrell (1957).**

RESULTS AND DISCUSSION

The effect of organic materials and bio-fertilizer on plant behavior is not only a matter of nutrients supply, but also it influences the physical chemical and biological characteristics of soil which in turn influence the plant growth.

1- Nitrogen fertilizer and some soil properties:

Soil reaction (pH) shows a little change as a result of addition different nitrogen fertilizer sources Table (3) this might be due to the soil buffering capacity that resists the change of its soil reaction. The values of soil pH show alkaline reaction and they range between 8.22 and 8.40. Soil salinity values differ among nitrogen fertilizer treatments and could be arranged in descending order of CN > SM > SM + EMH < C > EMH > SM + EM > EM (table 3). The highest value of soil salinity (408 usm) is observed in the soil fertilized by ammonium nitrate which in fact is a real salt. The lowest value of soil salinity (269 usm) is recorded in the soil treated by bio-fertilizer. Soil organic carbon realize obvious change by using different nitrogen fertilizers and could be arranged in descending order of SM + EM > CN > C > EM > EMH >SM > SM + EMH Table (3).

Plus bio-fertilizer compared to the soil treated by sheep manure or bio-fertilizer only, respectively. This might be due to the existing of organic materials that increase the biological activity and provide the energy and nutrients needs for organic materials decomposition **(Abuzahra and Tahboub, 2008)**.

Table (3): Synergetic effect of organic fertilizer and EM on pH, EC and OC after harvest of sunflower plant.

Treatments	pH	EC (uSm^{-1})	OC (%)
Control	8.40	296	1.05
CN	8.32	408	1.06
EM	8.27	269	0.77
EMH	8.24	289	0.69
SM	8.22	323	0.64
SM+EM	8.22	282	1.17
SM+EMH	8.26	323	0.41

The soil organic carbon increases by 83 & 52% when the soil treated by sheep manure.

2- Seed yield and its quality:

Data in Table (4) indicate the seed yield its components and seed quality are significantly increased as a result of addition different nitrogen fertilizer sources. Seed weight/head or seed yield (kg/fed)are increase by 15.16, 25.56 and 36.10% when soil treated by sheep manure compared to sheep manure plus bio-fertilizer (SM + EM), chemical fertilizer (CN) and sheep manure plus bio-fertilizer plus humic acid (SM + EMH), respectively. Seed weight/head or seed yield (kg/fed) could be arranged in descending order of SM > SM + EM > CN > SM + EMH > EMH > EM > C. The increase in seed weight/head and seed yield mieght be due to that mixing organic fertilizer with effective microorganisms enhance the metabolic process such as net assimilation rate that increase growth characters and yield components. **(Esmaeilian *et al.*, 2012)**.Seed index (weight of 1000 seeds) significantly increases by using different nitrogen fertilizers. The seed index could be arranged in descending order of SM + EMH > SM + EM > CN > EMH > EM > SM > Control. It is worth to mention that the combination between nitrogen fertilizer given higher value of seed index than individual nitrogen fertilizer. The highest value is recorded in the plot treated by sheep manure + effective microorganisms + humic acid. This may be due to adding SM + EMH act as a store house of several macro and micronutrients effectively which are released during the process of mineralization **(Han *et al*., 2007**).

Table (4): Synergetic effect of nitrogen fertilizers and EM on sunflower yield and its quality.

Treatments	Weight	Seed	Seed	Oil	Seed

	seed\ head (g)	**index 1000-seed weight** (g)	**yield** (Kg/fed)	**yield** (Kg/fed)	**protein** (%)
Control	68.11	68.42	1029.82	285.35	23.61
CN	104.67	73.18	1582.56	529.40	30.05
EM	83.00	72.57	1254.96	376.33	25.95
EMH	90.11	72.94	1362.46	391.17	24.83
SM	131.42	71.93	1987.12	641.67	29.31
SM+EM	114.12	81.21	1725.54	535.21	32.76
SM+EMH	96.56	82.40	1459.94	544.46	33.88
LSD 0.5	14.95	5.56	226.06	89.39	NS

Generally, all fertilizer treatments significantly increase seed oil percentage and oil yield. The maximum values of seed oil content and oil yield (37.27 % & 641.67 kg/fed, respectively) are detected on the plants grown in the soil treated by sheep manure compared with the other fertilization treatments. Seed oil content increases by 11.62, 15.42 & 20.23%. Oil yield increases by 17.85, 19.89 & 21.21% when soil tested with sheep manure compared with SM + EMH, SM + EM and CN, respectively. Seed oil content or oil yield could be arranged in descending order of SM > SM + EMH > SM + EM > CN > EMH > EM > Control.

Protein content in seeds is significantly affected by application of different nitrogen fertilizers. The highest protein content (33.88 %) was recorded on the plants grown in soil treated by SM + EMH fertilizers. Protein content in seed increases by 3.42, 12.75 & 15.59% when soil treated by SM + HEM compared with SM + EM, CN and SM, respectively. This may be due to

the increase in the other major elements, brought about by the good supply and positive effect of nitrogen uptake that encourage the uptake of the available macro nutrients (**Nanjundappa *et al.*, 2001**).The protein content in seed could be arranged in descending order of SM + EMH > SM + EM > CN > SM > EM > EMH > C. The obtained results are in accordance with those reported by **(Akbari *et al.*, 2011 and Esmaeilian *et al.*, 2012)**.

3- Yield loss caused by wild birds:

Data presented in Table (5) show the light of losses due to birds at two ripening stages for sunflower crop (doughy and mature stage) under the conditions of nitrogen fertilizer treatments. The field observations showed that, house sparrow, *Passer domesticus niloticus* (L.) hooded crow, *Corvus corone cornix* (L.) and palm dove, *Streptopelia senegalensis egyptica* (L.) starts to attack sunflower plants from seed formation till the harvest time.

Dough ripe stage:

Data of this stage of grain ripening through growing season, are presented in the same table it was found that, the lowest damage was occurred in descending order of (SM+EM, Control and SM fertilizer treatment). The average of total damage were (4.00, 4.33 & 4.67%), with insignificant difference between them. The fertilizer treatments (CN, EM and EMH) ranked the second order (6.00, 6.00 & 6.67%), with insignificant difference between them. But the highest damage was recorded in SM+EMH fertilizer treatment (13.33%), with highly significant differences between this fertilizer treatment and other treatments.

Mature ripe stage:

Data presented in the same table demonstrates the percentage of damage caused by birds, during the mature

stage. The lowest calculated damage percentages were revealed with EMH, SM, CN and Control (8.00, 8.67, 8.67 & 8.67%), respectively, with insignificant difference between them. The fertilizer treatment (SM+EMH) ranked his second order (10.00%), with insignificant difference between the control, CN and SM fertilizer treatments. But, there is significant difference between EMH fertilizer treatment and other treatments. The highest damage was recorded in SM+EM fertilizer treatment (14.00%), with highly significant differences between this fertilizer treatment and other treatments.

In general, the statistical analysis of data, representing the interaction, revealed that there are significant differences between the doughy and mature stages in yield losses caused by birds; the yield losses being 6.43 & 10.05 %, respectively.

Regarding, impact of nitrogen fertilization on damage caused by birds in sunflower crop. The results revealed that, the lowest damage was recorded in control, SM, CN and EMH fertilizer treatments (6.50, 6.67, 7.33 & 7.33%), respectively, with insignificant difference between them. But, the fertilizer treatments (SM+EM and EM) ranked the second order (9.00 &9.17%), with insignificant difference between them. The highest damage was recorded in (SM+EMH) fertilizer treatment. The mean of total damage was (11.67%), with highly significant differences between this fertilizer treatment and other treatments.

Table (5): Different nitrogen fertilizers and sunflower yield losses by wild birds.

Treatments		Growth stages		Mean
		Doughy stage	Prey-harvest	
Control		4.33 fg	8.67 bc	6.50 **C**
CN		6.00 ef	8.67 bc	7.33 **C**
EM		6.00 ef	12.33 a	9.17 **B**
EMH		6.67de	8.00 cd	7.33 **C**
SM		4.67 fg	8.67 bc	6.67 **C**
SM+EM		4.00 g	14.00 a	9.00 **B**
SM+EMH		13.33 a	10.00 b	11.67**A**
Mean		6.43 B	10.05 A	8.24 **C**
LSD $_{0.05}$	Growth stage	NS		
	Fertilizers	1.21		
	Interaction	1.71		

Relationship between loss birds and rate of oil and Protein in seeds on sunflower crop:

Data in Table (6) show the relationship between the damage caused by birds and rate of oil and Protein in seeds on sunflower crop. The results revealed that there correlation between the damage caused by birds and the rate of oil and protein in seeds on sunflower plants. This indicated that the increase and decrease of damage caused by birds is related to the rate of oil and protein in sunflower seeds. It has been observed that the lowest yield losses are 6.50 % with rate of oil and protein (27.61 & 23.61%) in soil untreated by any fertilizer (control). While the highest yield of losses are 11.67 % with rate of oil and protein (37.27 & 33.88%) in soil treated by (SM+HEM). Wild bird species cause serious damage to sunflower yield and could be arranged in descending order of SM + EMH > EMH > EM > SM+EM > CN = EMH > SM > Control on sunflower plants. This is may be due to that the birds prefer to feed on mature seeds (that have high oil and protein content) more than that on doughy stage which provide them by enough energy needed **(Abd EL-Gawad *et al.*, 2010)**.

Table (6): Relationship between loss birds and rate of oil and Protein in seeds on sunflower crop.

Treatments	Seeds oil (%)	Protein in seeds (%)	% of damage birds
Control	27.61	23.61	6.50
CN	33.39	30.05	7.33
EM	29.99	25.95	9.17
EMH	28.71	24.83	7.33
SM	32.29	29.31	6.67
SM+EM	31.00	32.76	9.00
SM+EMH	37.27	33.88	11.67

4- Economic Analysis of the technical efficiency of the fertilizer treatments and economic losses:

Data in Table (6) show the efficiency ratios of different fertilizer treatments by using analysis Envelopment models. The data indicate that treated the soil by CN, EM and SM+EM achieves technical efficiency ratio of 100%. The estimated rate of efficiency one true each is considered as showed and check chemical fertilizer treatment (CN). Production rise and less cost (its one of the conditions of economic efficiency), and check treatment fertilizer (SM) the highest production and costs higher, while check fertilizer treatment (SM+EM) had given production is higher than derived from treatment (CN). Most of the profit and the cost of inferior treatment (SM), as the two treatments (Control and EM) input technically, with an estimated technical efficiency for each including about (65 and 79%), respectively. On the other hand the treatments (SM and SM+EM)

more workers in terms of economic loss by wild birds, especially in the process of maturation, which highlights the importance of focusing on transactions (SM and SM+EM) and a private treatment (SM+EM) and the need to recommend the level of the Republic and try to overcome or reduce the attacking birds, especially in the process of maturity.

Table (7): Indicators of economic efficiency of treatments fertilizer on sunflower crop.

Treatments	Total costs (LE)	Revenue (LE)	The loss		*Technical efficiency (%)
			Seed (g)	Money (LE)	
Control	0	3089.46	309.33	927.99	0.65
CN	1096	4747.68	310.00	930.00	1.00
EM	200	3764.88	281.00	843.00	0.79
EMH	240	4087.38	248.33	744.99	0.86
SM	315	5961.36	376.66	1129.98	1.00
SM+EM	515	5176.62	311.00	933.00	1.00
SM+EMH	355	4379.82	211.66	634.98	0.96

*Calculated data in tables (4) and (5) Table using model Data Envelopes Analysis model (DEA).

CONCLUSION:

Finally, under the current experimental conciliation, it could be concluded that

the work within hand granted an evidence to the effective role of adding organic fertilizers in combination with biofertilizers on vegetation growth, seed yield and its quality of sunflower plants. That is true, since these treatments are overcoming the problem of the little amount of organic matter content that play an important role in enhancement the physical and chemical soil properties.

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الكفاءة الإنتاجية لبعض الأسمدة النيتروجينية وتأثيرها على الخسارة المسببة بواسطة الطيور البرية فى محصول دوار الشمس

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الملخص العربى

أجريت هذه الدراسة في المزرعة التجريبية لكلية الزراعة - جامعة الأزهر - أسيوط – مصر، لدراسة تأثير بعض معاملات التسميد كمصدر للنيتروجين {بدون تسميد(Control)، تسميد كيميائى (CN)، تسميد حيوى(EM)، حمض الهيوميك+ سماد حيوى (EMH)، سماد أغنام(SM)، سماد أغنام + سماد حيوى(SM+EM) و سماد الأغنام+(EMH)}على محصول دوار الشمس وعلاقتها بالخسارة الناتجة عن مهاجمة الطيور البرية لمحصول دوار الشمس. وقد أظهرت النتائج أن التربة التي أضيف إليها سماد الأغنام + حامض الهيوميك + المركب الحيوي قد زادت صفات النبات زيادة معنوية (دليل الحصاد ، محتوى الزيت والبروتين بالبذور) وكانت أعلى قيمة لوزن البذور لكل نبات ومحصول الحبوب والزيت للفدان 131,42 ، 1987,12 ، 641,67 كجم على الترتيب وقد هاجمت الطيور البرية نباتات دوار الشمس في الطور العجيني ومرحلة النضج التام حتى الحصاد مسببة ضرر جسيم لرؤوس النباتات. وقد سببت الطيور البرية نقص في محصول دوار الشمس بحوالي 6.5 ، 6,67 ، 7,33% في معاملة الكنترول ، وسماد الأغنام ومعاملة التسميد الكيماوي = معاملة حامض الهيوميك + السماد الحيوي على الترتيب. وكانت أعلى خسارة في محصول دوار الشمس فى معاملة سماد الأغنام + حامض الهيوميك + السماد الحيوي وهي (11.97%). عند تقدير الكفاءة الإنتاجية للمعاملات السمادية وعلاقتها بالخسارة المسببة بواسطة الطيور البرية ، وجد أن هناك ثلاث معاملات حققت نسبة كفاءة 100% من بين المعاملات وهي المعاملات [بدون تسميد (كنترول) ، سماد الأغنام (SM) ، سماد أغنام + سماد حيوى(SM+EM)] وعند حساب التكاليف الاقتصادية وجد أن المعاملات السمادية[بدون تسميد (كنترول) ، التسميد الكيميائى (CN)] أعطت أقل إنتاج بأقل تكاليف (احد شروط الكفاءة الاقتصادية)، وتحقق المعاملة السمادية سماد أغنام(SM) أعلى إنتاج بتكاليف أعلى، بينما تحقق المعاملة السمادية [سماد أغنام + سماد حيوى(SM+EM)] إنتاج أعلى من المتحقق من معاملة التسميد الكيميائى (CN) معظم للربح وتكاليف أدنى من المعاملة سماد أغنام(SM) ، كما أن المعاملتين (الكنترول و التسميد الحيوى(EM) غير كفؤتين تقنياً حيث تقدر الكفاءة التقنية لكل منها بنحو (65% و 79%) على التوالي، وعلى الجانب الآخر تعتبر المعاملات سماد أغنام(SM) و السماد الحيوى(SM+EM) أكثر المعاملات من حيث الخسارة الاقتصادية في محصول دوار الشمس من جانب الطيور البرية ،

وخاصة في طور النضج ، الأمر الذي يبرز أهمية العناية بالمعالمتين وخاصة معاملة السماد الحيوى (SM+EM) وضرورة التوصية بها على مستوى الجمهورية ومحاولة التغلب على أو الحد من مهاجمة الطيور لها وخاصة في طور النضج الكامل لمحصول دوار الشمس. وتوصي الدراسة بالأخذ بالمعاملة السمادية (SM+EM) المحتوية على سماد الأغنام بجانب الـ EM ،حيث تحقق متطلبات الكفاءة الإنتاجية بإنتاج أعلى وتكاليف أقل، وتعميم تلك التوصية على مزارعي دوار الشمس على مستوى الجمهورية ، كما توصي بضرورة التجميع الزراعي لمحصول دوار الشمس للتغلب على مهاجمة الطيور البرية للمحصول والعناية به وخاصة في طور النضج. كما توصي الدراسة بسرعة حصاد محصول دوار الشمس فور نضجه حتي لا يتعرض لمهاجمة الطيور البرية بصورة أكبر ويقل المحصول وبالتالي تقل إنتاجية الفدان.