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ORIGINAL ARTICLE

GENETIC ACTION HERITABILITY RATE, EXPECTED GENETIC IMPROVEMENT AND COEFFICIENT OF DIFFERENCE FOR FOUR VARIETIES OF ABLAND COTTON *GOSSYPIUM HIRSUTUM* L. BY NANO FERTILIZER EFFECT

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Abstract: This study was conducted during the 2020 summer season to study the impact of genetic action, estimate the proportion of heritability, expected genetic improvement and variation factors for four varieties of *Gossypium hirsutum* L. cotton with the effect of four levels of nanoscale manure (0.10, 20.30 mg.l^{-1} and varieties are (Inglis, Cocker 310, Montana IK378,). The seeds of varieties were planted in Babil province, Al-Musayib project area using the experience of its workers according to the design of the full random sectors RCBD and three bis to study the characteristics of vegetable growth and the product and the qualitative qualities. The study showed that the inheritance rate is high for all the qualities studied for four concentrations of nanos manure except for the **t**wo qualities, the number of fruit branches and early plants was medium and achieved concentration of 10 mg. With a fiber intake, the expected genetic improvement achieved the highest value at a concentration of 10 mg.l^{-1} with a total of 37.08 liters, a plant with a walnut number. The values of the factor of appearance difference showed a difference between the qualities, with a concentration of 20 and 30 mg.l^{-1} of nanoscale manure are the highest variation factors for some qualities, reaching the highest (41.74), (34.86) plants with the number of walnuts in succession.

***Key words*:** Genetic action, Heritability rate, Abland cotton, *Gossypium hirsutum* L.

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1. Introduction

Gossypium hirsutum L. cotton crop is one of the most important fibre crops in the world and grown on more than 32 million hectares in 76 countries. It is also one of the most important fibre crops in Iraq, along with wheat, barley, steel, maize, white corn and sunlight [Shihab and Abood (2019)] and increased productivity of the unit of area of flower cotton is at the forefront of the concerns of crop breeders in all countries of the world interested in cultivating it, including Iraq.

Nanotechnology is one of the important and proposed solutions to increase grazing production as more food can be produced at lower costs with lower energy consumption rates and thus reduced environmental pollution, nanomaterials are materials that are at least one of their dimensions the size of nanoparticles and constitute one billion *i.e.* by limits 10-9 meters and be in range (1 nm to less than 1µm) and as nanotechnology provides ample scope for new uses in the fields of biotechnology, agriculture and fertilizer industry since nanoscale properties have physical properties. It is uniquely chemical because of its high surface area, so alternative natural sources of the nanofertilizer industry can be used to reduce environmental pollution, provide safety and health to

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humans, as well as reduce the economic costs arising from the use of chemical fertilizers [Mahmoud *et al*. (2017), Da'ad and Al-Jubouri (2006)]. Nanotechnology plays a major role in crop production while preserving the environment from pollution presents nanoparticles in mixed forms to mitigate their inhibitory effects in different plant species, compared to individual exposure to nanoparticles [Dimkpa *et al*. (2015)]. Sivaprasad (2003) concluded that the inheritance rate in the broad sense of the trait of the number of days to open the first flower and net milk reached 24.5%, 19.4%, 2.4%, 29.5%, respectively. Al-Nuaimi (2006) reached the percentage of broad sense heritability ranged in (0.671 and 0.996) to the level of the number of vegetable branches respectively. Many researchers have found the positive effect of nanofertilizers for micro-elements in improving growth, output and representation efficiency Photonics and other vital processes of many crops [Mandeh *et al*. (2012)]. The use of nano fertilizer is one of the most widespread molecules and used for its positive effect in improving plant growth [Drostkar *et al*. (2016), Chitgupekar *et al*. (2004)]. It has been found that spraying the cotton crop with milky zinc nano, traditional milk zinc and three sprays according to the stages of growth compared to water spraying only has improved the vesal processes in cotton and morally superior to the content of chlorophyll, the dry weight of the plant and the number of walnuts in the plant [Rezaei and Abbasi (2014)]. This paper is aimed to study estimating the expected inheritance and genetic improvement rate under the intensity of the 5% election and estimating the variation factor in the tested varieties.

2. Materials and Methods

Tested varieties and studied qualities

In this study, four varieties (Coker 310, Angeli, Montana Origin America and IK378 Origin Greece) of Abland cotton were used. It was obtained from prof. Jassim Jawad Jader (plant breeder) in plant production techniques.

The field study was carried out in Babil province, Al-Musayib project area, during 2020 with soil with a green clay mixture tissue and illustrated its physical and chemical qualities (Table 1). Physical and chemical analysis of soil was carried out in the Soil laboratory, Faculty of Agriculture, University of Baghdad. Four varieties of abland cotton and four nanopost traxammen used micro-elements (0.10, 2030) mg. l^{-1}. The seeds of the varieties were planted on April 27, 2020 and agriculture was in furrow 4 meters long and the distance between the furrow was 75 cm and the distance between the pits was 25 cm, where three furrows of each class were planted using the order of panels in the design of the working experiment according to the

Table 1: Some physical and chemical qualities of the soil at the study site.

Traits		Values	Unit
Degree of interaction (pH)		7.5	
Electrical receipt score (EC)		3.40	DS.M-1
Melted positive ions	Calcium	20.1	MG.KG-1
	Sodium	3.9	MG.KG-1
	Potassium	0.106	MG.KG-1
	Iron	3.048	MG.KG-1
	Manganese	0.3614	MG.KG-1
	Copper	0.5984	MG.KG-1
	Zinc	0.8954	MG.KG-1
	The Mulpidium	0.036	MG.KG-1
	Boron	2.18	MG.KG-1
Total nitrogen		84	MG.KG-1
Organic matter		12	
Soil separators	Sand	350	MG.KG-1
	Green	530	MG.KG-1
CLAY	120	GM.KG-1	
TISSUE CLASS	placer clay mixture (SILTY CLAY LOAM)		
VIRTUAL DENSIT	1.52	KG.M-3y	

design of the randomized complete block design (RCBD) with three replicates and included one replicate on 16 experimental units and cultivars occupied the main plots and Fertilization treatments occupied the subplot, fertilizer DAP at a rate (25 kg/dunum) at once before agriculture and urea fertilizer (N%46) at a rate of 120 kg/dunum) and all soil and crop service operations were conducted The nano-compost was added to the smaller elements described in Table 2 sprayed on the leaves with different concentrations (10, 20, 30) added with 20 liters of water per concentration with a comparison that is (0 mg) and the first batch was added 30 days after the planting date and the second batch 60 days after the planting date. Studies were conducted on 5 guarded plants taken from each furrow for each item and then calculated.

The following qualities were studied: the number of days to open the first flower, the height of the plant, the number of vegetable, fruit branches, the percentage of chlorophyll, the diameter of the leg, the number of nodes until the first fruit branch, the number of open walnuts, the weight of walnuts, the factor of seed, the factor of early treatment, the ratio of net milk, the factors of hill, the product of cast cotton, the product of fiber, the length of the hill, elongation and the durability of the hill and the softness of the hill.

Heritability and Expected genetic advance.

$$\%H^2B.S. = \frac{\sigma_G^2}{\sigma_P^2} x100$$

where, $H^2B.S.$ represents inheritance in a broad sense, σ_G^2 is the genetic variability of characteristic and σ_P^2 is the appearance contrast of the character.

Estimated expected GA genetic improvement is given by the following equation.

$$G.A = K.\ H^2_{B.S.}\ \sigma_P$$

where, G.A represents genetic improvement, $H^2_{B.S.}$ is inheritance in a broad sense, σ_p is the Standard deviation of appearance contrast and K is the intensity of the election and is equal to 2.06% when 5% of plants are elected.

The expected genetic improvement is estimated as a percentage of the overall average of the characteristic in:

$$E.G.A = \frac{G.A}{\bar{X}} \times 100$$

where, E.G.A represents the expected genetic improvement as a percentage of the overall average characteristic, G.A is the expected genetic improvement and $\bar{X}$ represents the average adjective.

Also according to PCV% appearance difference factor is as follows:

$PCV = (\sigma p / x)\% \times 100$

where, x = Arithmetic average.

3. Results and Discussion

Heritability in broad sense

The values of the average Broad sense heritability ranged from 56% medium to the early treatment factor to the high, reaching 98% for most traits, where the highest Broad sense heritability the opening of the first flower and the height of the plant, and the number of vegetable branches and the percentage of chlorophyll and the diameter of the plant stem, the number of Nodes, the number of nuts and the weight of nuts and the fiber and the product of cast cotton and elongation and length and softness. Table 3 shows inheritance in the broad sense of the qualities studied by the effect of four levels of nanoscale concentration 0, 10, 20, 30 $mg.l^{-1}$, less than 40% are low, 60-40% are medium and more than 60% are high. The hertibility rate in a broad sense was high for the number of days to open the first flower, reaching 96.95 percent. The concentration of 10 mg.l-1 gave the highest average for plant height at (99.07%), at the concentration of 30 $mg.l^{-1}$, the number of vegetable branches was high (96.10%), at a concentration of 30 $mg.l^{-1}$ and was high for fruit branches (95.39%). The concentration of 10 mg.l-1 gave the highest Broad sense heritability average of 100 seeds at (98.48) , while the concentration of 20 $mg.l^{-1}$. At the concentration of 20 $mg.l^{-1}$, the heritability rate in a broad sense was high for the diameter of the plant leg.

It was 98.43 percent. At the concentration of 10

Table 2: Contents of Comblete Micro Fertilizers Chelated Khazr Nano.

Element	Iron	Manganese	Copper	Zinc	Molbidium	Boron
Percentage	**8 %**	1.5%	0.5%	1.5 %	0.5%	0.5%

Table 3: Heritability broad sense of four nano fertilizer concentrations in abland cotton.

Heritability (broad sense)																					
Concentrations	Open the first flower.	Plant height cm	Vegetable branches num.	Fruit branches num.	Chlorophyll ratio	Diameter leg plant	Number of bonds to the first fruit branch	Number of balls	Nut weight gm/pl.	Weight 100 seeds gm.pl	Fiber yeild	The durability of the fig	Net ginning ratio	Early treatment plants	Cotton yield gm/pl.	Elongation	The length of the fig the staple	Smoothness of the staple	The Bug Guide
0	82.14	94.98	94.32	40.21	98.48	90.44	83.59	93.56	86.80	98.21	95.61	91.71	89.05	85.29	96.78	91.74	79.44	79.48	98.47
10	96.95	90.54	87.38	95.39	90.66	98.43	94.53	86.85	91.43	88.95	99.77	95.60	98.58	87.29	98.19	98.01	96.49	86.03	97.77
20	95.05	95.05	94.08	51.25	97.87	93.10	97.35	75.46	79.60	98.75	99.16	98.78	95.29	92.20	94.68	96.35	91.79	80.32	98.05
30	92.40	99.07	96.10	68.90	87.02	94.50	96.61	99.50	88.41	90.20	98.32	97.64	94.52	56.18	92.20	97.43	91.80	84.88	89.48

mg.l^{-1}, high with the number of nodes up to the first fruit branch with a level of 97.35%. At the concentration of 20 mg.l^{-1}, the number of walnuts was very high (99.50%). At the concentration of 30 mg^{-1} and the weight of the nut showed a high inheritance rate of 91.43%. At the concentration of 10 mg.l^{-1} and a high heritability rate of 100 seeds at (98.75) at the concentration of 20 mg.l^{-1}, the heritability rate increased in a broad sense with the fiber product by reaching (99.77%). At the concentration of 10 mg.l^{-1}, the heritability rate in a broad sense with the durability of the tilt showed a high percentage of 98.78%. At the concentration of 20 mg.l^{-1}, the heritability rate in the broad sense of elongation of the **tyla** increased to 98.01%. At the concentration of 10 mg.l^{-1}, the heritability rate in the broad sense of the length of the tilt showed a high concentration of 10 mg.l^{-1} with a score of 96.49%. With the smoothness of the **fig**, it is noted that the heritability rate is high at 86.03 percent. At the concentration of 10 mg.l^{-1}, it was very high with the tilt guide at the concentration of 0 mg.l^{-1} with 98.47%. The heritability rate increased in the broad sense of the net milking ratio to 98.58 percent. At the concentration of 10 mg.l^{-1}, the early coefficient showed a high concentration of 20 mg.l^{-1}. The cast cotton product showed a high concentration of 10 mg.l^{-1} at 98.19 percent. These results are consistent with Al- Nuaimi and Sarhid (2017), who noted that the high values of some of these qualities facilitate the opportunity to improve these qualities through direct election.

Expected genetic improvement

Table 4 shows the values of expected genetic improvement as a percentage of the overall average of the qualities studied by affecting four levels of nanopost concentration (0, 10, 20, 30) mg.l^{-1}. It is 10% lower and between 10-30% average and more than 30% high. It should be noted that the values of the expected genetic improvement as a percentage to the overall average of the characteristic are low for the number of days until the opening of the first flower, reaching 2.59 at the concentration of 10 mg.l^{-1} and the height of the plant reached 5.47 cm at the concentration of 30 mg.l^{-1} and the percentage of chlorophyll as it reached 9.72 at the concentration of 30 mg.l^{-1} and the length of the tilt as it reached 9.94 at the concentration of 0 mg.l^{-1} and the smoothness of the petal reached 7.70 at the concentration of 30

Table 4: The expected genetic improvement of four nanoscale concentrations in abland cotton.

Genotypic coefficient of variation / Concentrations	Open the first flower.	Plant height cm	Vegetable branches num.	Fruit branches num.	Chlorophyll ratio	Diameter leg plant	Number of bonds to the first fruit branch	Number of balls	Nut weight gm/pl.	Weight 100 seeds
0	1.45	3.74	7.61	11.09	5.75	9.62	9.79	28.95	11.30	13.91
10	2.59	2.54	11.76	20.46	8.57	16.92	7.64	37.08	9.45	13.21
20	2.42	4.94	11.17	12.23	5.24	9.21	12.04	36.26	5.63	11.12
30	2.33	5.47	14.26	9.19	9.72	19.53	9.49	34.77	9.60	17.90

Genotypic coefficient of variation / Concentrations	Fiber yeild	The durability of the fig	Net ginning ratio	Early treatment plants	Cotton yield gm/pl.	Elongation	The length of the fig the staple	Smoothness of the staple	The Bug Guide
0	18.49	13.26	7.01	8.34	11.37	10.82	9.49	4.58	4.00
10	15.72	14.52	3.82	9.72	14.22	8.53	6.34	2.62	18.50
20	26.24	15.49	4.39	12.48	16.89	6.39	2.00	3.40	13.91
30	23.53	15.56	6.37	12.72	24.10	8.74	2.79	7.70	13.22

mg.l^{-1} and net ginning percentage at 7.01 at the concentration of 0 mg.l^{-1} and the weight of the nut and the elongation of the staple reached an average value of concentration 0 mg.l^{-1} amounted to 11.30 for the weight of the nut and 11.29 for the elongation of the hill while it was low for the rest and the value of genetic improvement was medium for the number of vegetable branches at (14.26) (7.61). At the concentration of 30 mg.l^{-1}, the number of fruit branches reached 20.46 at the concentration of 10 mg.l^{-1} and the diameter of the plant leg was 19.53 at the concentration of 30 mg.l^{-1} and the number of nodes up to the first fruit branch reached 12.04 at the concentration of 20 mg.l^{-1} and the weight of 100 seeds reached 17.90 at the concentration of 30 mg.l^{-1}. The the concentration of 30 gm.l-1 gave the highest cast cotton product at 26.24mg, while the concentration of 20 mg.l^{-1} gave the highest early treatments plants ,concentrations are 10,0 mg.l^{-1} and the average concentration is 30.20 mg.l^{-1}. High with walnuts 28.95, 37.08, 36.26 and 34.77 for four concentrations of nanoscale manure (0, 10, 20, 30) mg.l^{-1}. These results are consistent with what Al-Nuaimi and Sarhid (2017) found that most genetic traits have genetic improvement values between medium and low.

Coefficient of difference

Table 4 shows the values of the processes of the apparent variation of the qualities studied under the influence of four levels of nanopost concentration 0, 10, 20, 30 mg.l^{-1}. According to the percentages of low, medium, and high concentrations inside a single genetic structure based on features, 10% is low, 10-30% is medium, and more than 30% is high.

It should be noted that the values of the factor of appearance difference are low with the number of days to open the first flower at 2.59 at the concentration of 10 mg.l^{-1} and the height of the plant reached 5.49 cm at the concentration of 30 mg.l^{-1}. The smoothness of the hill was 8.36 mg at the concentration of 30 mg.l^{-1} and the net ginning ratio was 7.42 at the concentration of 0 mg.l^{-1}, while the number of vegetable branches was low to focus 0 mg. 30 liters of nanoscale fertilizer and an average of 10,20,30 mg.l^{-1} of nanoscale fertilizer at 14.55 mg at concentration of 30 mg.l^{-1} and note that the variation coefficient with chlorophyll ratio is low for 0, 10, 20 mg.l^{-1} of nano-fertilizer and an average concentration of 30 mg.l^{-1} of nano-fertilizer, reaching

Table 5: Shows the factor of the appearance variation of four nanoscale compost concentrations in Abland cotton.

phenotype coefficient of variation					
Concentrations	0	10	20	30	
Open the first flower.	1.59	2.59	2.48	2.42	
Plant height cm	3.83	2.54	5.06	5.49	
Vegetable branches num.	7.83	11.76	11.52	14.55	
Fruit branches num.	17.48	20.95	17.09	11.07	
Chlorophyll ratio	5.79	8.57	5.30	10.42	
Diameter leg plant	10.11	16.92	9.55	20.09	
Number of bonds to the first fruit branch	10.71	7.64	12.20	9.65	
Number of balls	29.93	37.08	41.74	34.86	
Nut weight gm/pl.	12.13	9.45	6.31	10.21	
Weight 100 seeds	14.04	13.21	11.19	18.84	
Fiber yeild	18.91	15.72	26.35	23.73	
The durability of the fig	13.85	14.52	15.59	15.75	
Net ginning ratio	7.42	3.82	4.50	6.56	
Early treatment plants	9.03	9.72	13.00	16.98	
Cotton yield gm/pl.	11.56	14.22	17.36	25.10	
Elongation	11.29	8.53	6.51	8.86	
The length of the fig the staple	10.65	6.34	2.09	2.91	
Smoothness of the staple	5.14	2.62	3.80	8.36	
The Bug Guide	4.03	18.50	14.05	13.98	

10.42. As for the early treatment plants coefficient, the coefficient of variation is low for concentrations of 10.0 mg.l^{-1} of nano-fertilizer and an average of 20.30 mg of nano-fertilizer, reaching 16.98 for a concentration of 30 mg.l^{-1}, while the coefficient of difference was average with the number of fruit branches at 20.95 mg.l^{-1} at the concentration of 10 mg.l^{-1} and the weight of 100 seeds, it was 18.84 at the concentration of 30 mg.l^{-1} and the fiber holder was 26.35 at the concentration of 20 gm.l^{-1}. 10.35 mg.l^{-1}, the durability of the fibre 15.75 at the concentration of 30 mg.l^{-1} and the cotton cast yield reached 25.10 at the concentration of 30 mg.l^{-1}.The fiber index was at low concentration of 0 mg.l^{-1} and average for 10, 20, 30 mg.l^{-1} of nano fertilizer at 18.50 at concentration of 10 mg.l^{-1}, while the diameter of the plant leg was low at concentration of 20 mg.l^{-1} of nanoscale fertilizer and average compositions 30, 10, 0 mg.l^{-1} of the nano-fertilizer, it reached 20.09 at concentration of 30 mg.l^{-1} and the number of contracts up to the first fruit branch at the concentration of 10, 30 mg.l^{-1}. It was low and average concentrations of 0, 20 mg.l^{-1} as it reached 12.20 at a concentration of 20 mg.l^{-1}, the weight of the nut showed concentration of 0, 30 mg.l^{-1} average as it reached 12.13 at the concentration of 0 mg.l^{-1} and low for 20, 10 mg.l^{-1}. The elongation was average at the concentration of 0 mg.l^{-1}, it reached 11.29, while the coefficient of difference was high with the number of walnuts, it was 29.93, 37.08, 41.74 and 34.86 at four concentrations of nano-ifertlizer 0, 10, 20, 30 mg.l^{-1}. These results are consistent with the findings of Al-Nuaimi (2010) and Abd AL-Hseenand Manea (2020).

The study concludes that the heritability rate is high for all the qualities studied for four concentrations of nanoscale manure except for the two qualities the number of fruit branches and early treatment was moderate and achieved concentration of 10 mg.l^{-1}, highest heritability (99.77) with fiber yield, the expected genetic improvement achieved the highest value at a concentration of 10 mg.l^{-1} with a total of 37.08, a plant with a walnut number. The values of the factor of appearance difference showed a difference between the qualities, with a concentration of 20 and 30 mg.l^{-1} of nano manure are the highest treatments of difference for some traits, with the highest (41.74), (34.86) plants with the number of nuts.

We recommend using focus 10 mg.l^{-1} of

nanoscale manure to achieve the highest inheritance rate and the highest expected genetic improvement and concentration of 20 and 30 mg.l^{-1} of nanos manure to achieve the highest percentage of the coefficient of difference.

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