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ORIGINAL ARTICLE

The Response of Qualitative and Quantitative Characteristics of Ajowan(*Carum copticum*) to Organic and Chemical fertilizers under drought Stress Condition

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ABSTRACT
This experiment was conducted to find the influence of drought stress, organic and chemical fertilizers on Ajowan plant (carum copticum). A split plot experiment performed on a randomized complete blocks design with three replicates. Three levels of drought stress (50, 70 and 90 % of field capacity) considered as main plots and six levels of fertilizer included non-fertilizer consumption (control), bestial fertilizer, compost, NPK, 50% bestial fertilizer + 50% NPK, 50% compost+ 50% NPK, as subplots. Quantitative traits(sprig height, number of pileups, thousand seed weight, aerial organs weight, bald performance) and qualitative characteristics (essence percent, essence performance) were measured. . The results showed that drought stress significantly decreases the quality and quantity performance of Carum copticum($p \leq 0.05$). with increasing drought stress on non-fertilized plots, seed performance, growth statue and performance of essence in each hectare(ha) was significantly decreased($p \leq 0.05$). Application of organic and chemical fertilizers has a positive effect on the resistance of plant against drought stress and prevents the performance reducing of the plant under this condition. The most essence performance in 1 hectare was achieved by bestial fertilizer + NPK in 70% field capacity (110.71 kg/ha) and the most seed performance was achieved by NPK in 70% field capacity (2918.89 kg/ha).
Keywords: *Ajowan, drought stress, fertilizer, medicinal Plant*

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INTRODUCTION

Side effects of chemical drugs, compulsions of biological environments, gradual and multilateral tendency toward therapeutic plants especially in the last decades lead to the development countries allocate hundreds of their farmlands to planting therapeutic herbs. The Ajowan (*Carum Copticum*) is a therapeutic plant from the Apiaceous family. The provenance of *C. Copticum* is India and Mediterranean area [1]. *C. Copticum* grows in India, Pakistan, Iran, Egypt and etc. In traditional medicine, it is used as carminative (tonic),anti Adnauseam , strengthened, vermicide, diuretic, reducer of the blood cholesterol, phlegm bringer and spasmSoothing .Nutrition Management of the plant in drought stress condition is considered to be one of the most important issues in agriculture and crop production. The plant which has received enough nutrition showed the more resistance against drought condition [2]. Also it effects on the quality and quantity of the plant production. Therefore, Adding nutrient elements may increase plant resistance in the stress condition. For instance, under drought stress, adding fertilizer in the early stages of the plant growth cause to use more water by plant also it can have negative effects during the critical stages of growth [3].Increasing the plant growth by nutritional elements under drought stress condition may promote water and nutritional elements extraction from the deep layers of soil [4].
Ardekani et al., [5] observed that the maximum performance of aerial organs, height, leaf length and width in *Melissa Officinalis* was caused by the unstressed attendance but the majority of essence performance was from the 60 % of field capacity. Also the results of

research on the quality and quantity performance of medicinal plants represent that drought stress caused reduction in performance quality of *Dracocephalum Moldavia*. [6,7], reduce growth and essence of *Mentha Piperita*, and increase the percent of basil essence [8,9]. Mandal et al., [10] showed that usage of different amount of chemical fertilizers has remarkable effects on the growth and performance of *Plantago Ovata*. Also, the majority of the seed performance was caused by usage of 60 kg of nitrogen in each hectare and increasing the performance of nitrogen caused increasing in all glucose of leaf [10].

Superabundant consumption of fossil fuels in producing chemical fertilizers, pollution of dust and water which is caused by these fertilizers and other chemical materials and also reducing in quality of agricultural productions are the reasons of these issues. Francis [11], Scheffer et al.[12] showed that organic fertilizers are effective in planting medical plant and producing biomasses, it also increases the extracted compositions. Ferguson [13] reported that using of 20 ton (t) from the compounds which are extracted from the urban waste in each ha increased the Vegetables performance about 15%. Many study showed that compress usage of chemical fertilizers reduces the performance of agricultural plant [14]. The main reasons of this reducing are dust acidifying and the lack of enough nutritional elements in NPK fertilizers [14,5]. Bestial fertilizers can stultify the dust PH and support some economical elements such as: ZN, Boron and AUG. organic and chemical fertilizers provide an ideal qualification for the plant growth. Unfavourable effects of long term and irregular usage of chemical fertilizers is confirmed by Zhang *et al.,* [15]and [16].

One of the most important elements effect is the reducing of dust fertility which is caused by destruction of humus. Organic fertilizers haven't these undesirable effects and they also increase the amount of humus in the dust and help to keep it in a suitable condition.

In the other hands, humus created by organic fertilizers iindirectly. Organic fertilizers increase the effects of chemical fertilizers and also increase the consumption efficiency of the fertilizers. Chen et al , [17] showed that using a fertilizer which is a compound of organic and chemical NPK fertilizers and other mineral ingredients increased the growth and the performance of pepper (*Piper betle*) plant. Akhtar–Jahan, [18] reported that the performance of Pan (*Piper Betle*) increased by using of chemical and bestial fertilizers together. Although extensive research has been done on the effects of stress on crops but a little research has been done on the performance of medical plants under water stress and different types of fertilizer. This study investigated the effects of drought stress and six types of bestial fertilizer, chemical, compost,50%compost+50%npk,50% bestial fertilizer +50%npk on the yield, performance of essence and morphological characteristics in ajowan plant.

MATERIALS AND METHODS

This experiment carried out in the autumn of 2012 in the experimental farm of Pardis, University of Zabol, Iran. Experiment was arranged as a randomized complete block with three replications. 18 plots (2*3 m) were placed in each main block. Soil characteristics of the experimental site are presented in Table 1. Drought stress was considered as a main factor. In the drought stress treatment, three different watering levels, irrigation and 50, 70, and 90 % of field capacity, were used. Also different type of fertilizers were considered as secondary factor in six levels including control, chemical fertilizer, bestial fertilizer(20t/ha), compost of rural dump(40t/ha), chemical fertilizer(50%), chemical and bestial fertilizers (50 and 50%)+ compost fertilizer(50%). *C. capsicum* seeds were obtained from the faculty of agriculture, university of Zabol, Zabol, Iran. Seeds were sown in the soill. Irrigation was started immediately after planting and it was done daily until the seed germination and then it was done once in 7 to 10 days.

After 20 days of growth, essence performance in plot, plant height, number of leafs in herb, number of pileup in plant, thousand grain weights and weight of aerial organs was measured.

Seed collecting is done when the seed colour change from green to yellow. Aerial organs was dried in shade and dry environment condition. Filtration method was used for extracting of the essence .

Statistical analysis

Each treatment was conducted with three replicates and the results were presented as mean ± SE (standard error).The results were analysed by one way Enova with used Statistical Package for Social Sciences (SAS) Version 11.5. Results and discussion

RESULT AND DISCUSSION

Weight of aerial organs

The effects of drought stress and different type of fertilizers on the aerial organs of *C. Copticum* are shown in Table 3 .the results showed that with increasing drought stress to 50 % of field capacity, the weight of aerial organs reduce about 22/70%. Usage of NPK chemical fertilizer significantly increased the aerial organs weight(6/24gr/plant) (p≤0.05).also the results showed that the aerial organs weight increased in chemical fertilizer NPK(6/24gr/plant)in compare than control(47/51), bestial fertilizer(15/69), compost + NPK(12/36), bestial +NPK(10/21) and compost the results showed that the effect of different fertilizers on the aerial organs weight depends on the drought stress level. In the 50 % of field capacity, the chemical fertilizer NPK treatment has the maximum aerial organ weight (8 g in each plant), and it was significantly different with other fertilizer treatments (p≤0.05). Chemical fertilizer NPK releases its nutrient materials faster than any other fertilizer. Therefore, the plant gain more nutrient materials and grow well at the drought stress, so this fertilizer has the most effect on the aerial organs of *C. Capsicum*.

At 70% of field capacity, the maximum weight of aerial organs was recorded in compost +NPK (7.01 g in a plant) and at 90 % field capacity, bestial fertilizer+NPK had the maximum weight (7/01gr/plant).

Sprig height

The effects of drought stress and different fertilizers on the sprig height presented in table4

The results showed that with increasing the drought stress level to 50% of field capacity, the plant height increase about 2/24 %. The maximum plant height was observed at 90% of field capacity (84/72 cm) and the minimum sprig height was recorded at the 50% of field capacity (82/86 cm). Ddifferent fertilizers had significant effects on sprig height of *c. capsicum*(p≤0.05). The maximum sprig height was recorded in NPK treatment (96/95 cm). The results showed that effect of different fertilizers on sprig height depend on drought stress. At 50 % of field capacity, chemical fertilizer +NPK had the maximum sprig height (100 cm) and it was significantly different with other fertilizers(p≤0.05).. At 70% of field capacity, the maximum sprig height was recorded in bestial fertilizer +NPK (99/30 cm)it has significantly difference with other fertilizer except compost(p≤0.05). In level 90% of field capacity, NPK has the maximum amount of sprig height (99/20 cm).

Pileup number

The effect of drought stress and different type of fertilizers on the Pileum number of *C. Copticum* are presented in table5. Different levels of drought stress have direct effect in increasing or reducing the Pileup number. The maximum number of Pileup was observed at 70% of field capacity (26/55 Pileup in a plant) and the minimum Pileup number was recorded at 50% of field capacity (24/22 Pileup in a plant). The maximum Pileup number was observed in bestial fertilizer+ NPK treatment (30/81 Pileup in a plant) there was a significant difference between bestial fertilizer+ NPK and other fertilizer (p≤0.05).

At 50 % of field capacity, bestial fertilizer+ NPK has the maximum Pileup number (28/55 pileup in a plant). At 70% of field capacity, the maximum Pileup number was observed in bestial fertilizer +NPK treatment (33/13 Pileup in a plant) there was a significant difference between bestial fertilizer +NPK and other fertilizer(p≤0.05).. At 90% of field capacity, the NPK fertilizer has the maximum Pileup number (32/03 Pileup in a plant) and it was significantly difference with other fertilizer (p≤0.05).

Seed weight (performance)

The effect of drought stress and different type of fertilizers on the seed weight of Ajwan are shown in table 6.

The results showed that different levels of stress50, 70 and 90% field capacity have direct effect in increasing or reducing the seed weight. In general, the maximum amount of seed weight was observed at 70 % of field capacity (1859/35 kg/ha) and the minimum seed weight was recorded at 50% of field capacity (1517/83 kg/ha). The maximum weight of seed was observed tin bestial fertilizer +NPK (2408/52 kg/ha). It has significant difference with other fertilizer(p≤0.05). We observed that the amount of fertilizer can be ddifferently affected on the seed weight, in various drought levels. At 50% of field capacity, bestial fertilizers +NPK has the maximum seed weight (2496/11 kg/ha) and at 70 % of field capacity, the maximum seed weight was recorded in NPK with 2918/89 kg/ha. It was significantly difference with other fertilizer(p≤0.05). At 90% of field capacity, the fertilizer NPK+ bestial has the maximum amount of seed weight (2150/55 kg/ha)there was significant difference between the fertilizer NPK+ bestial treatments and other fertilizer(p≤0.05).

Thousand grain weights

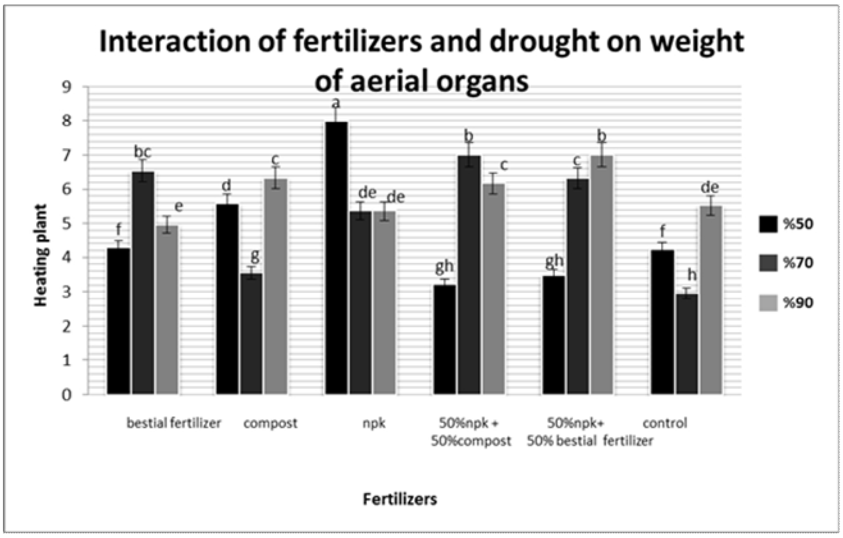
The effects of drought stress anddifferent fertilizers on the thousand grain weights are shown in table 7). Different levels of drought stress has significant effects on the thousand grain weights (p≤0.05).,. The maximum amount of seed weight (0/72 g) was measured in 70% of field capacity The minimum amount of thousand grain weights (0/68 g) was recorded in 50%

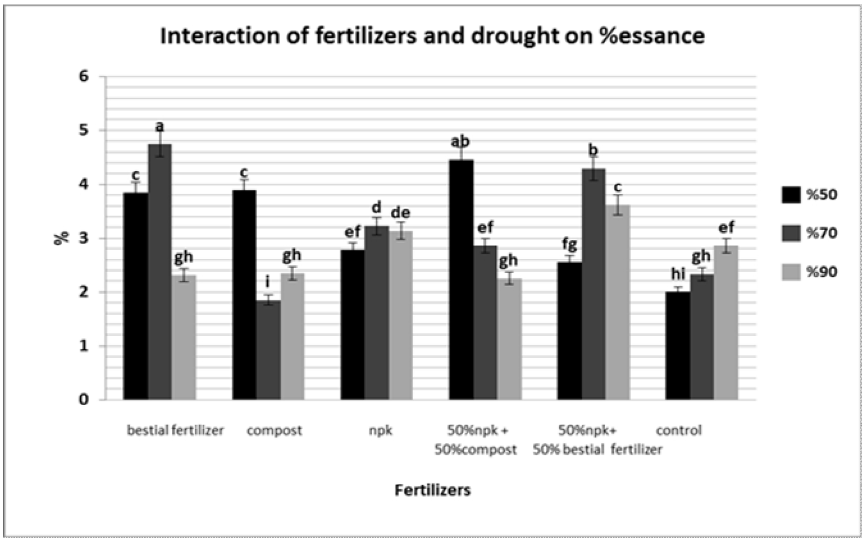
of field capacity. The results showed that, the maximum amount of thousand grain weights was measured in bestial fertilizer +NPK (0/81 g). The effects of fertilizers on the thousand grain weights depend on the drought stress level. At 50% of field capacity, NPK has the maximum amount of thousand grain weights (0/72). it has a significant difference with all treatment except the control($p \leq 0.05$). At 70% of field capacity, the maximum amount of thousand grain weights was observed in bestial fertilizer +NPK (0/93g) and it has significant difference with all treatments($p \leq 0.05$). At 90% of field capacity, the maximum amount of thousand grain weights was recorded in bestial fertilizer+ NPK (0/87 g). there was a significant difference between bestial fertilizer+ NPK and other treatments($p \leq 0.05$).

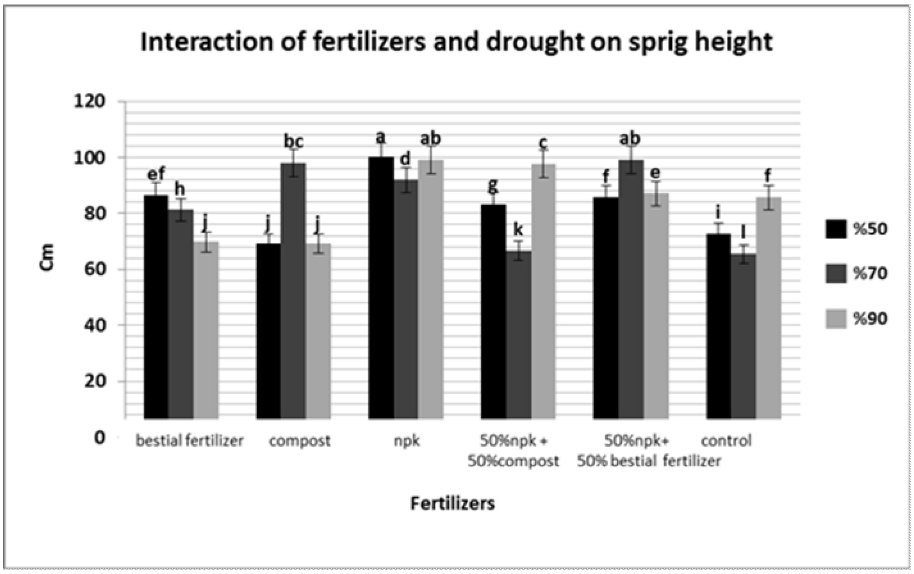
Essence performance

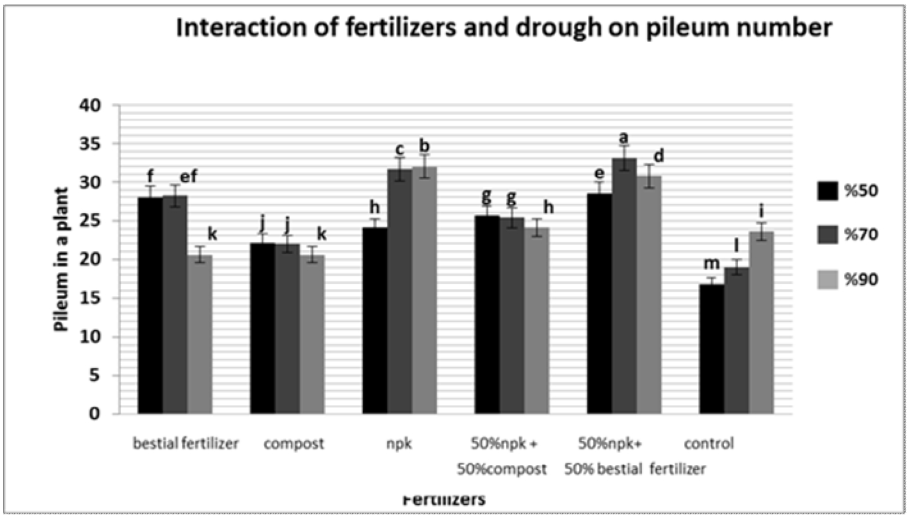
The effects of drought stress and different type of fertilizers on the essence performance of *C. Copticum*are are presented in table 8. The maximum amount of essence performance (43/42 kg/ha was measured at 70%) of field capacity. The results showed that, the maximum amount of essence performance was recorded in bestial fertilizer + NPK (84/05 kg/ha and there was significant difference between bestial fertilizer + NPK and other treatments ($p \leq 0.05$). the results showed that effects of fertilizers on the essence performance depends on the stress level. At 50% of field capacity, the compost fertilizer +NPK treatment has the maximum amount of essence performance (64/89 kg/ha.)

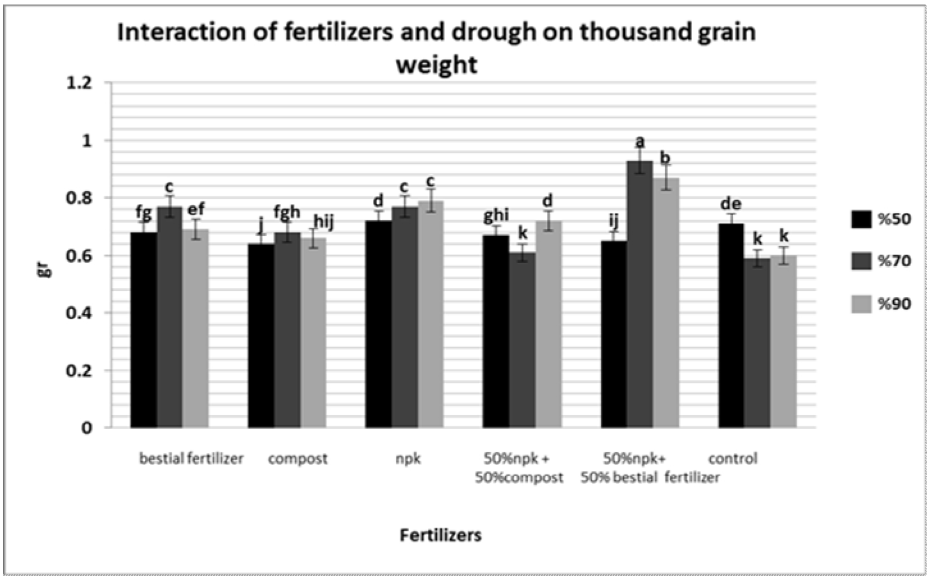
At 70% of field capacity, the maximum amount of essence performance was measured in bestial fertilizer +NPK (110/71 kg/ha). It has a significant difference with other fertilizer($p \leq 0.05$). At 90% of field capacity, the bestial fertilizer +NPK treatment has the maximum amount of essence performance (77/72 kg/ha). There was significant difference between bestial fertilizer +NPK and other treatments ($p \leq 0.05$).






Interaction of fertilizers and drought on sprig height
Cm
Fertilizers
bestial fertilizer
compost
npk
50%npk + 50%compost
50%npk+ 50% bestial fertilizer
control
%50
%70
%90


Interaction of fertilizers and drough on pileum number
Pileum in a plant
Fertilizers
bestial fertilizer
compost
npk
50%npk + 50%compost
50%npk+ 50% bestial fertilizer
control
%50
%70
%90


Interaction of fertilizers and drough on thousand grain weight
gr
Fertilizers
bestial fertilizer
compost
npk
50%npk + 50%compost
50%npk+ 50% bestial fertilizer
control
%50
%70
%90

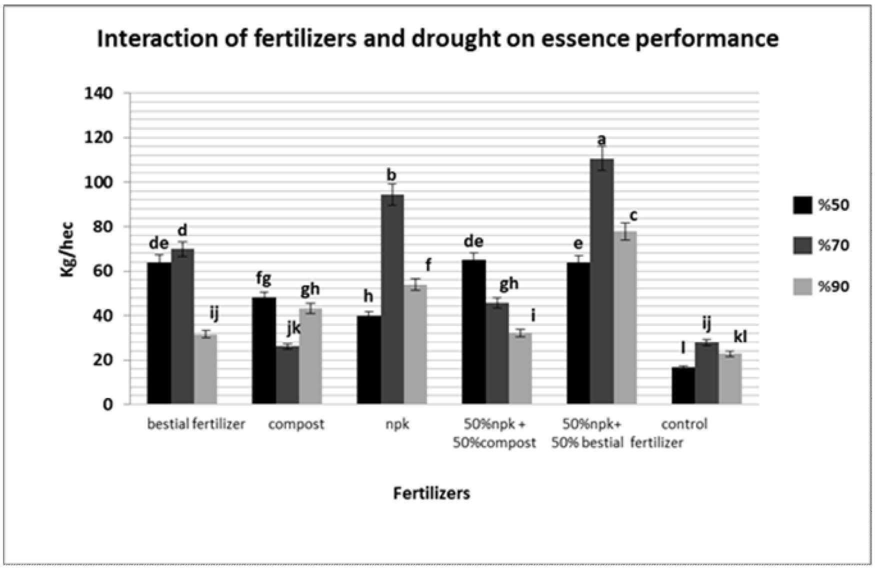


Table1: Soil characteristics of the experimental site

Dust texture	sand	clay	sludge	MG	ZN	FE	k	P	N	Organic material	Exterior weight	pH	Electricity conduction
	Per cent			ppm					Per cent		g/cm3		(ds/m)
Sandy	48	31.6	20.4	2.80	3.2	1.97	119	9.45	0.09	0.87	1.49	8.2	1.5

Table2: analysing the quality and quantity variance of *C. Copticum* under the effects of fertilizers and drought stress

Squares average						Freedom degree	Different resources
Essence performance	Seed weight	Seed performance	Pileum number	Sprig height	Aerial organs		
16.20	0.00	119.68	0.06	0.53	0.17	2	**repetition**
16930.07**	0.01**	648899.50**	24.62**	15.60**	5.44**	2	**stress**
0.07	0.001	3315.56	0.00	0.18	0.05	4	**Main error**
4019.40**	0.04**	2348265.91**	162.70**	633.89**	3.88**	5	**fertilizer**
1007.11**	0.01**	384644.95**	29.60**	462.09**	7.83**	10	**Fertilizer*stress**
7.76	0.00	2579.27	0.03	0.23	0.06	30	**Secondary error**
5.38	**1.34**	**3.09**	**0.70**	**0.58**	**4.92**	**Change coefficient**	

Average	beholder	Bestial+ NPK	Compost+ NPK	NPK	compost	bestial		
4.80c	4.23f	3.48gh	3.22gh	8.00a	5.58d	4.28f	50	Drought stress farming capacity %
5.29b	2.96h	6.32c	7.01c	5.37b	3.55g	6.55bc	70	
5.89a	5.52de	7.01b	6.18b	5.36c	6.34c	4.96e	90	
SE=0.26 CV=4.92	4.23e	5.60b	5.47b	6.24a	5.16d	5.26cd		average

Table3: Interactional effect of fertilizers and drought stress on aerial organs(*Carum copticum*)

Table4: Interactional effect of fertilizers and drought stress on the pileum number

average	beholder	NPK+bestial	NPK+compost	NPK	compost	bestial		
24.22c	16.86m	28.55e	25.66g	24.08h	22.14j	28.05f	50	Drought stress(fa rming
26.55a	19.01l	33.13a	25.41g	31.66c	21.92j	28.19ef	70	
25.27b	23.57i	30.76d	24.08h	32.03b	20.59k	20.57k	90	
SE=0.17 CV=5.58	19.81f	30.81a	25.04d	29.26b	21.55e	25.60c	average	

Table5: Interactional effect of fertilizers and drought stress on the weight of bald seed (kg in a hectare)

average	beholder	NPK+bestial	NPK+compost	NPK	compost	bestial		
1517.83b	832.53i	2496.11b	1452.78g	1431.11g	1233.89h	1660.55ef	50	Drought stress(far
1859.35a	1193.89h	2578.89b	1593.33f	2918.89a	1400.55g	1470.55g	70	
1544.81b	761.11i	2150.55c	1430.55g	1714.44e	1841.11d	1371.11g	90	
SE=5.78 CV=3.09	929.18d	2408.52a	1492.22c	2021.48b	1491.85c	1500.74c	average	

Table6: Interactional effect of fertilizers and drought stress on the weight of thousand seed (g).

average	beholder	NPK+bestial	NPK+compost	NPK	compost	bestial		
0.68b	0.71de	0.65ij	0.67ghi	0.72d	0.64j	0.68g	50	Drought stress(fa rming
0.72a	0.59k	0.93a	0.61k	0.77c	0.68fgh	0.77c	70	
0.72a	0.60k	0.87b	0.72d	0.79c	0.66hij	0.69ef	90	
SE=0.009 CV=1.34	0.63e	0.81a	0.66d	0.76b	0.66d	0.71c	average	

Table 7: Interactional effect of fertilizers and drought stress on the essence performance(kg in a hectare).

average	beholder	NPK+bestial	NPK+compost	NPK	compost	bestial		
49.55b	16.65l	63.74e	64.89de	39.86h	48.16fg	64.03de	50	Drought stress(farming capacity %
62.42a	27.87ij	110.71a	45.62gh	94.47b	26.02jk	69.84d	70	
43.42c	22.76kl	77.72c	32.26i	53.90f	43.14gh	31.73ij	90	
SE=2.78 CV=5.38	22.09f	84.05a	47.59d	42.74b	39.10e	55.20c	average	

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