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Multiple regression analysis for studied traits in hormonal seed priming of sesame (*Sesamum indicum*) cultivars

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Abstract

In order to study multiple regression analysis for studied traits in sesame (Sesamum indicum) cultivars greenhouse and field experiments were conducted during 2012-2013 in Islamic Azad University, Tabriz Branch, Iran. Treatments were GA and Kinetin at five concentrations of 0, 50, 100, 150 and 200 ppm. To formulate the relationship among five independent growth variables measured in our experiment for sesame crop with a dependent variable, multiple regression analysis was carried out for the root bulk, capsule number per plant, capsule length, 1000 seed weight and seed yield; and oil yield as a dependent variable. Also, the stepwise regression analysis was carried out for the data obtained to test the significance of the independent variables affecting the oil yield. Based on orthogonal comparison results there is no significant difference between two sesame cultivars. The stepwise regression analysis verified that the root bulk, capsule number per plant and seed yield had a marked increasing effect on the sesame oil yield.

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Introduction

Sesame seed is one of the oldest oilseed crops known. It was a major summer crop in the Middle East for thousands of years. Sesame is drought-tolerant and is able to grow where other crops fail. Sesame has one of the highest oil contents of any seed (Raghav *et al.*, 1990).

For thousands of years, sesame seeds have been a source of food and oil. Sesame has one of the highest oil content of any seed, some varietals exceeding 50 percent oil content compared to soybean's 20 percent. Sesame oil is one of the most stable vegetable oils, with long shelf life, because of the high level of natural antioxidants. Oil from the seed is used in cooking, as salad oils and margarine, and contains about 47 percent oleic acid and 39 percent linoleic. Sesame seed oil, like sunflower seed oil, is rich in Omega 6 fatty acids, but lacks Omega 3 fatty acids (Oplinger and Putnam, 2012).

Azadi *et al.* (2013) result showed that seed priming treatments significantly ($p \leq 0.01$) affected, germination percentage, germination index and means time to germination after aging. Priming with gibberelic acid (GA), salicylic acid (SA) and ascorbic acid (ASC) increased germination characteristics of seed aged. The highest germination percentage, germination index, normal seedling percentage and enzyme activity were achieved in control conditions. Antioxidant activity of aged seeds increased after seed priming. In a study conducted by Mirshekari (2014) those seeds treated in gibberlic acid and kinetin of 50-150 ppm germinated faster. Except of gibberlic acid and kinetin of 50 ppm, other treatments had lower seedling dry weight.

This study was aimed to multiple regression analysis for studied traits in sesame (Sesamum indicum) cultivars.

Materials and methods

Greenhouse and field experiments were conducted on a sandy loam soil during 2012-2013 growing season at the Agricultural Research Station of Islamic Azad University of Tabriz (Lat. 38°, 5´; Long. 46°, 17´ and elevation 1360 m), East Azerbaijan, Iran on two sesame (Sesamum indicum) cultivars as Ultan (M_{11}) and Yekta ($Karaj_{29}$), separately, with three replications. Tabriz is located in the north-west of Iran and the climate is semiarid and cold; in spite of dispersed precipitation in summer, it's arid and average annual precipitation is 270 mm.

The seed priming tests of sesame (Sesamum indicum) were performed in a completely randomized design, using solutions of GA and Kinetin at five concentrations of 0, 50, 100, 150 and 200 ppm. There were three replications of each priming solution. Seeds were soaked in the required aqueous solutions of hormones. Each treatment involved weighing approximately 10 g of the seed in to a plastic cup, adding 20 mL of the priming solution (sufficient to submerge seeds), and allowing the seed and solution mixture to stay covered with plastic cup for 12 h. Seeds, after soaking, were rinsed three times with distilled water to remove excess salts from the seed coat, as described by Johnson *et al.* (2005).

Field study

The experimental area was ploughed in the fall and manured with 8 t ha^{-1}. Fields were cultivated, disked, furrowed and then plotted in the spring before sowing the seeds. Fertilizers used, in spring and before sowing, were 80, 20 and 90 kg ha^{-1} of ammonium phosphate, potassium sulfate and urea, respectively. The sesame seeds were sown on 6 May, 2013. All plots were hand removed for other weed species in growth season. Plots were irrigated immediately after sowing to assure uniform emergence.

In order to comparison of two sesame cultivars with a view to studied traits orthogonal analysis was conducted. In statistics, stepwise regression includes regression models in which the choice of predictive variables is carried out by an automatic procedure (Draper and Smith, 1981). In this study, to formulate the relationship among five independent growth variables measured in our experiment for sesame crop with a dependent variable, multiple regression analysis was carried out for the root bulk (X_1), capsule number per plant (X_2), capsule length (X_3), 1000 seed weight (X_4) and seed yield (X_5); and oil yield (OY) as a dependent variable. The multiple regression equation for oil yield is as follows:

$$OY = 12.415 + 1.526(X_1) + 1.777(X_2) + 0.753(X_3) + 1.555(X_4) + 3.650(X_5) \quad (1)$$

Furthermore, the stepwise regression analysis was also carried out for the data obtained to test the significance of the independent variables affecting the oil yield. The stepwise regression equation is as follows:

$$OY = 10.000 + 2.123\ (X_1) + 2.444\ (X_2) + 4.199\ (X_5);\ R^2 = 76 \quad (2)$$

Results and discussion

Analysis of variance

Analysis of variance indicated that effect of studied treatments on root bulk, seed yield and oil yield was significant at 5%, and on capsule number per plant and capsule length was significant at 1% probability levels.

Table 1. Orthogonal comparison for studied variables in sesame cultivars.

Sesame cultivars	root bulk	capsule number per plant	capsule length	1000 seed weight	seed yield	oil yield
			Means of data			
Yekta	6.0	16.1	5.8	7.9	1723.5	530.9
Ultan	5.8	15.9	5.7	8.1	2137.1	558.4
Prob.	0.20	0.322	0.220	0.580	0.053	0.330

Mean comparisons

Orthogonal comparison for studied variables revealed that there is no significant difference between two sesame cultivars. The highest and positive effect of hormone priming on sesame root bulk obtained when its seeds treated with 50 ppm and 100 ppm of GA and kinetin. Whereas, with increasing of hormone concentrations this value restricted significantly (Table 2).

Capsule number per plant of sesame ranged from 22.5 capsule in 50 ppm GA up to 13.2 capsule in 150 ppm kinetin. Also, there is no significant difference among other treatments except 50 ppm GA (Table 2). Dubey *et al.* (2007) showed an increase in plant height and branches per plant when okra (*Abelmoschus esculentus* L. Monch.) seeds were primed.

Table 2. Mean squares of hormone priming for studied variables in sesame cultivars.

Treatments	root bulk	capsule number per plant	capsule length	seed yield	oil yield
GA 50ppm	9.8	22.5	6.6	1450	579
Kinetin 50ppm	7.9	15	6.1	1410	509
GA 100ppm	9.8	15.8	6	1348	584
Kinetin 100ppm	7.9	13.9	6.3	1270	518
GA 150ppm	5	15	5.6	1200	490
Kinetin 150ppm	4	13.2	5.3	1189	481
GA 20ppm	5	14.5	5.2	1040	420
Kinetin 200ppm	3.9	15	5.1	1001	408
Control	4.8	15.5	5.9	1210	500
LSD (5%)	1.30	3.90	0.40	63.6	33.7

When the sesame seeds primed with 50 ppm GA, the crop produced capsules with higher length of 6.6 cm, but only 5.1 cm from those seeds treated in 200 ppm kinetin (Table 2). The vigor of seeds can be improved by techniques generally known as seed priming, which enhance the speed and uniformity of germination, and finally yield attributes (Demir and Van De Venter, 1999).

Seed yield of crop plant ranged from 1450 kg ha^{-1} in 50 ppm GA up to 1001 kg ha^{-1} in 200 ppm kinetin. Also, there is no significant difference among 150 ppm, 200 ppm concentrations (Table 2). It is suggested that seed priming generally causes faster germination and field emergence, which have practical agronomic importance in crop production, especially under adverse environmental conditions (Mc Donald, 2000). In an experiment conducted by Mirshekari (2014) wheat seeds primed before sowing with gibberlic acid and kinetin could be recommended due to faster growth.

When the sesame seeds primed with 50 ppm and 100 ppm GA, the crop produced higher oil yield of averaged 582 kg ha^{-1}, but only 414 kg ha^{-1} from those seeds treated in 200 ppm GA and kinetin. Oil yield in non primed seeds was greater than higher concentrations of both GA and kinetin hormones (Table 2).

Conclusion

The stepwise regression analysis verified that the root bulk, capsule number per plant and seed yield had a marked increasing effect on the sesame oil yield.

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References

Demir I, Van De Venter HA. 1999. The effect of priming treatments on the performance of watermelon (*Citrullus lanatus* Thunb.) Matsum & Nakai) seeds under temperature and osmotic stress. Seed Science and Technology **27**, 871-875.

Draper N, Smith H. 1981. Applied Regression Analysis, 2d Edition, New York: John Wiley and Sons, Inc.
http://dx.doi.org/10.1021/jf60192a05

Dubey AK, Yadav JR, Singh B. 2007. Studies on induced mutations by gamma irradiation in okra (*Abelmoschus esculentus* (L.) Moench.). Progressive Agriculture **7(1, 2),** 46-48.
http://10.1111/j.1439-037X.2007.00287.x.

Johnson SE, Lauren JG, Welch RM, Duxbury JM. 2005. A comparison of the effects of micronutrient seed priming and soil fertilization on the mineral nutrition of chickpea (*Cicer arietinum*), lentil (*Lens culinaris*), rice (*Oryza sativa*) and wheat (*Triticum aestivum*) in Nepal. Experimental Agriculture **41,** 427-448.
http://dx.doi.org/10.1017/S0014479705002851

Azadi MS, Tabatabaei SA, Younesi E, Rostami MR, Mombeni M. 2013. Hormone priming improves germination characteristics and enzyme activity of sorghum seeds (*Sorghum bicolor*) under accelerated aging. Cercetări Agronomice în Moldova 6 (3), 49-59.
http://dx.doi.org/10.2478/v10298-012-0092-8

Mc Donald MB. 2000. Seed priming. In M. Black, J.D. Bewley, eds., Seed technology and its biological basis. Sheffield Academic Press Ltd., Sheffield, UK, 287–325.

Mirshekari B. 2014. Effect of hormonal and physical primings on improvement of seed germination and seedling vigor of wheat (*Triticum aestivum*). Seed Science and Technology **1 (3),** 22-33.

Oplinger ES, Putnam DH. 2012. Sesame. Purdue University.

Raghav R, Catlin D, Romero J, Cowley C. 1990. Sesame: New Approaches for Crop Improvement. Purdue University. http://dx.doi.org/10.1061/41173(414)438