



**Effects of vermicompost and nitrogen fertilizers on growth of Jimson weed (*Datura stramonium* L.) as a medicinal plant**

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**ABSTRACT**

An experiment was conducted in order to evaluate the effect of organic (3 and 6 ton/ha vermicompost) and chemical (150 and 300 kg/ha nitrogen) fertilizers on growth, seed dispersal and heteroblasty of jimson weed at green house of Shiraz University in 2012. The results showed that the highest and the lowest plant growth, seed production and seed dispersal was in 300 kg/ha N and 6 ton/ha vermicompost, respectively. Position of the seeds on maternal plant had an important influence on the emergence percentage. Seeds on the middle and lowest parts of the plants had less emergence percentage compared with those on the higher parts. In general, application of 300 kg/ha nitrogen accelerated the growth of jimson weed and increase dispersal and heteroblasty of the jimson seed.

**Keywords:** Jimson weed, vermicompost, heteroblasty, nitrogen, dispersal.

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**INTRODUCTION**

Jimson weed (*Datura stramonium* L.) belonging to Solanaceae family, mostly grow as a weed in tropical regions in some crops such as corn, soybean, sugar beet and tomato.

*Datura stramonium* has both toxics and medicinal properties. Jimson weed is used in skin disorder, ear pain, cough, fever and asthma. Leaves extract are externally used for injuries, wounds bleeding and pains. Juice of fruit is applied to scalp for falling hair and as antidandruff. Jimson weed contains biologically active substances such as alkaloids, atropine, scopolamine, tannin, carbohydrate and proteins. It is used in many drugs due to its analgesic and antiasthmatic activities [11].

Seeds of this plant have a seed dormancy that they cannot germinate in appropriate condition despite having high seed viability [6]. Seed dormancy is a natural adaptation to the environmental conditions which causes the appearance of plants in various time intervals and thus have more chance of being alive [3]. Weed control is one of the expensive and essential parts in agricultural products. Weeds spread in all lands as very successful and efficient organisms and they can decrease crop yields between 10 to 100 percent depending on the competitive capacity [5]. One of the main mechanisms in survival of weeds population named heteroblasty, is production of seeds with different germination ability from parent [6]. Seed size and its position on maternal plant is an important factor in germination and seedling vigor of the seeds. Environmental factors such as temperature, daytime, maternal plant height and time of ripening seeds on maternal plant have an important role in the survival of weed seeds [2]. Although application of chemical fertilizers can increase crop yields, but if used improperly, it can be unintentionally useful for weeds more than crops. Consumption of fertilizers can change the competitive abilities of weeds and crops, as the better response of weeds to nitrogen, leading to increase their interference and the competitive abilities against crop [5].

The purpose of this study was to evaluate the effect of the level and type of nitrogen fertilizer on growth of *Datura stramonium* maternal plant and on the next generation (seed).

## MATERIALS AND METHODS

This experiment conducted at Agricultural Research Station of Shiraz University as completely randomized block design with four replications in 2012. The seeds of *Datura stramonium* weed were collected from the farm Agricultural Research Station of Shiraz University.

Five experimental treatments were included: control (without fertilization), 3 and 6 t/ha vermicompost and 150 and 300 kg/ha nitrogen. The irrigation was performed as furrow, and each block had a separate drainage channel.

Jimson weed characteristics included plant height, number of leaves per plant, number of flowers per plant, number of seeds per capsule and thousand-grain weight were measured weekly. After plant maturity, when the earth was completely dry and seeds are easily visible on the ground, the distance of the maternal plant until the last seed was measured in order to determine the dispersal of *Datura stramonium* seeds. Three plant were selected from each plot and 100 seeds were harvested from upper, middle and bottom parts of the each plant for heteroblasty test. Then, the seeds in each treatment were planted in five kg pots and irrigated regularly. Emergence percentage was calculated by dividing the number of emerged seedlings by the total seeds sown.

### Statistical analysis

Data were analyzed using the analysis of variance (ANOVA), General Linear Model (GLM) procedure. Means comparison tests were performed with Least Significant Difference (LSD). All statistical analyses were performed using SAS software.

## RESULTS AND DISCUSSION

Assessment of the plant height showed that there was a significant difference between fertilizer treatments from the fifth week onwards. The highest the plant height was observed in application of 300 and 150 kg per hectare nitrogen with no statistically significant difference (Figure 1). It seems that nitrogen fertilizer increased the plant height by stimulating the vegetative growth of the plants. In the same vein, Hejman *et al* [5]. reported that the height of the weed *Rumex crispus* increased by application of nitrogen fertilizer. The lowest *Datura stramonium* plant height was observed in application of six tons per hectare vermicompost (Figure 1). Application of vermicompost at high levels has a negative effect on plant growth and photosynthesis, which by reducing of production and availability of assimilates and it can reduce the plant growth [4].

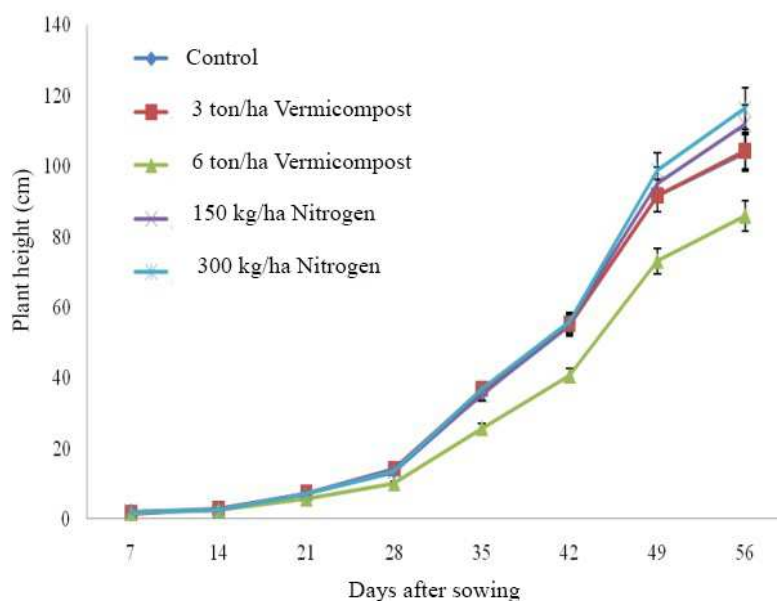
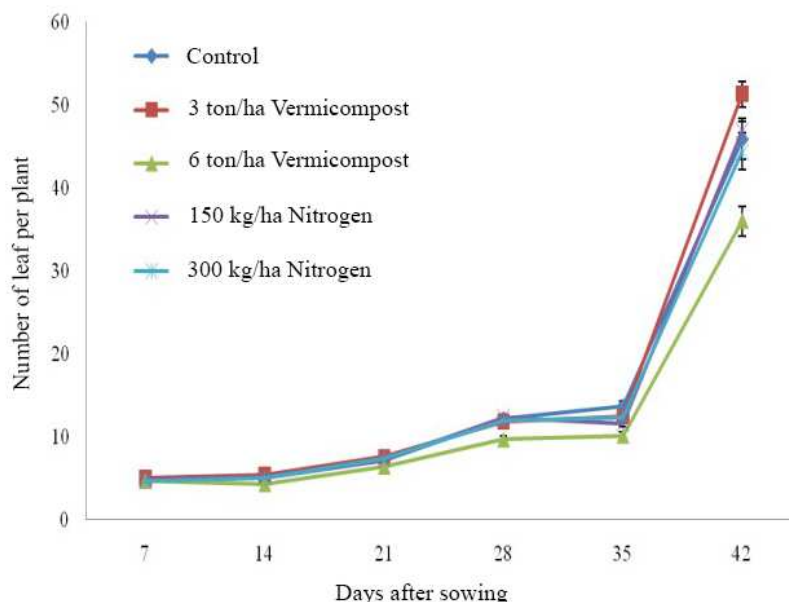


Figure 1. Effect of type and amount of fertilizer consumption on length of jimson. The means of the overlap don't have significant different the base on the LSD test.

The results showed significant differences were observed between treatments from the third week onwards for the number of leaves and the most number of leaves obtained in the 300 kg/ha nitrogen (Figure 2). Previous studies show that nitrogen has a significant effect on number of leaves per plant [5].

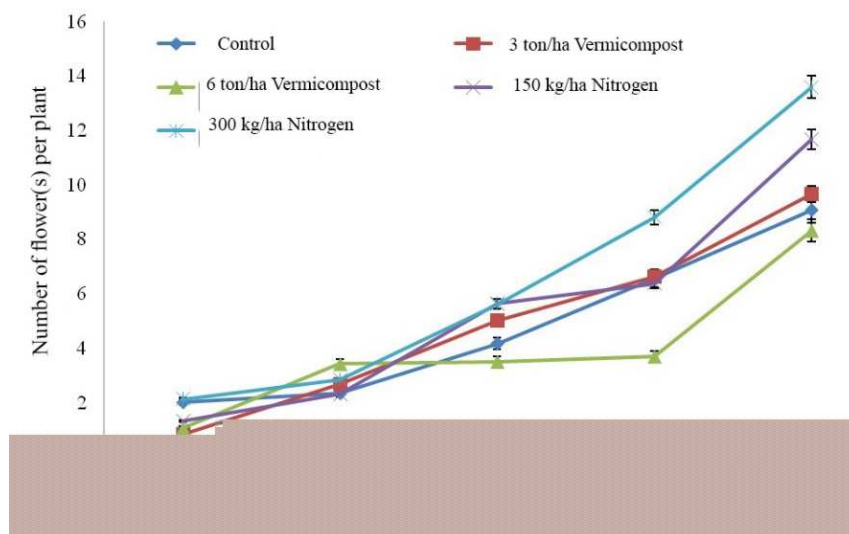
Application of vermicompost significantly reduced the number of leaves per plant compared to control in this study (Figure 2). In contrast to this result, Singh *et al.* (1998) showed that vermicompost fertilizer increased the number of leaves. Also, Kumawat *et al.* [9] reported that increasing vermicompost level enhanced vegetative growth of barley.



**Figure 2. Effect of type and amount of fertilizer consumption on number of leaf of jimson. The means of the overlap don't have significant different the base on the LSD test.**

The highest and lowest number of flowers per plant was observed in application of 300 kg/ha nitrogen and six ton/ha vermicompost, respectively (Figure 3).

It can be stated that the increasing the amount of vermicompost from 3 to 6 ton/ha caused reduction in fertility and consequently reduction in seed production and seed bank and long-term control of this weed in field of crops and vegetables. Although the effect of type and amount of applied fertilizer on number of seeds per capsule and thousand-grain weight was not significant, but the application of 150 and 300 kg per hectare nitrogen increased these parameters, however, there was no significant difference statistically with the other treatments.



**Figure 3. Effect of type and amount of fertilizer consumption on number of flower of jimson. The means of the overlap don't have significant different the base on the LSD test.**

Differences between treatments for number of capsules per plant were greater in nine weeks after planting and the maximum difference were observed ten weeks after planting. The highest and lowest number of capsules per plant was obtained in the 300 kg per hectare nitrogen and 6 ton/ha vermicompost, respectively. The number of capsules per plant was not significantly different between three ton/ha vermicompost and 150 kg/ha nitrogen, though they were higher than control (Figure 5).

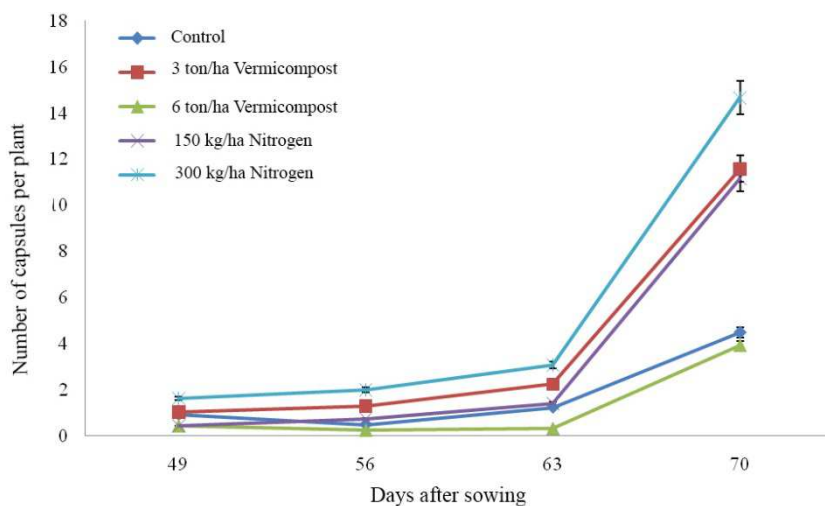


Figure 5. Effect of type and amount of fertilizer consumption on number of capsules per plant in jimson. The means of the overlap don't have significant different the base on the LSD test.

Though the type and amount of fertilizer was not statistically significant on number of seeds per capsule, however the maximum number of seeds per plant was observed in control with an average of 451 seeds per capsule, and the lowest seeds were in both levels of vermicompost with an average of 419 seeds per capsule (Figure 6). This results did not agree with Hassanpour *et al.* (1390). In agreement with this study, Saeidi *et al.* [12] that showed this trait has not been affected by chemical fertilizers.

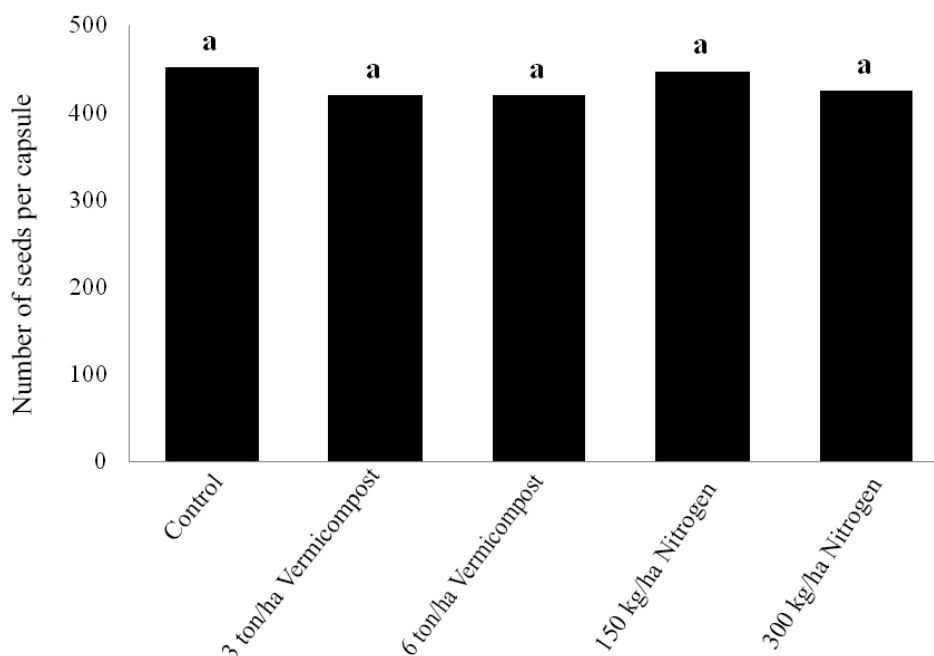


Figure 6. Effect of type and amount of fertilizer consumption on number of seeds per capsule plant in jimson. The means of the overlap don't have significant different the base on the LSD test.

There was no significant differences between thousand seed weight in fertilizer treatments (Figure 7). Sanchez *et al.* [13] also reported that application of vermicompost increased the yield of *Plantago major* L.

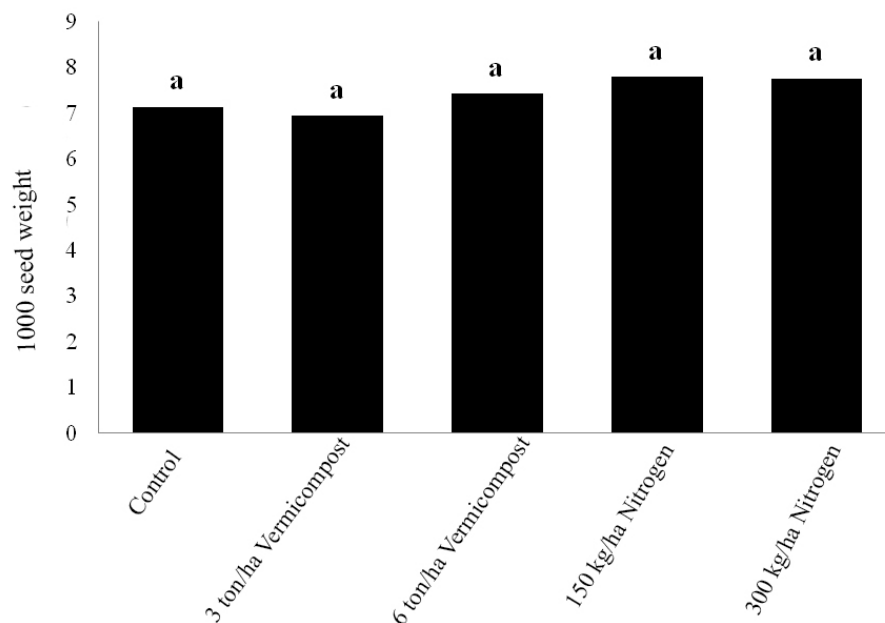


Figure 7. Effect of type and amount of fertilizer consumption on 1000-seed weight in jimson. The means of the overlap don't have significant different the base on the LSD test.

The highest (276 cm) and lowest (180 cm) seed dispersal was observed in application of 300 kg per hectare nitrogen and six tons of vermicompost per hectare (Figure 4). Dispersal distance of seeds from the mother plant is one of the fundamental aspects in the life cycle of plants and has a significant effect on evolution and survival of the plant [1]. Morphology of plant organs in relation with seeds dispersal such as maternal height, shape and size of the seed and also environmental conditions have a crucial effects on the movement of seeds [10, 7].

Results of former studies indicate this fact that the nutrition of maternal plant using different fertilizer treatments, had a significant effect on seed dispersal *Erodium cicutarium*, as, the distance from the maternal plants grown in adequate fertilizer conditions was more than inadequate fertilizer [8].

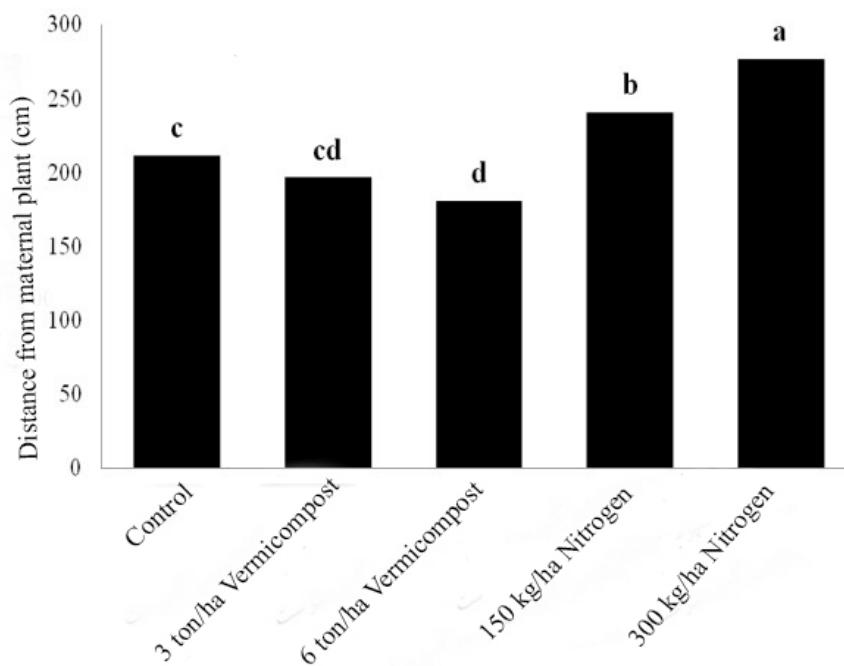


Figure 4. Effect of type and amount of fertilizer consumption on seed dispersal of jimson. The means of the similar letters don't have significant different the base on the LSD test.

Results of mean comparison of heteroblasty showed that the highest emergence percentage of *Datura stramonium* seeds in the upper part of the maternal plants under 150 and 300 kg/ha nitrogen and 3 tons of vermicompost per hectare (Table 1). Also, there were no significant differences between the emergence percentages of seeds collected from the lower and middle parts of maternal plants in any of the fertilizer treatments. The lowest emergence percentage of the middle and lower seeds of maternal plants was observed in the 6 tons per hectare vermicompost (Table 1).

Weeds with heteroblasty, have high diversity and variability to adaptation with the environment and also have more time of dispersal that causing tighter control of these weeds [5,8].

**Table 1. The effect of seed positioned in maternal plant on emergence percentage of seed of jimson under different fertilizer treatments.**

Control			Nitrogen						Vermicompost					
			150			300			3			6		
Up	Medium	Low	Up	Medium	Low	Up	Medium	Low	Up	Medium	Low	Up	Medium	Low
65.6b	51.4c	50c	68.5a	52.5c	50.3c	70.3a	52.6c	50.6c	68.6a	51.3c	49.6cd	64.2b	48d	47d

Means with the same letter within a column are not significantly different at the 1 % probability level according to the LSD test.

## CONCLUSION

In general, this study indicated that fertilizer treatments had a significant effect on growth characteristics of *Datura stramonium* and dispersal and heteroblasty of the produced seeds. Also, place of seeds on the maternal plant had an important influence on emergence percentage seed of *Datura stramonium*. Furthermore, application of 300 kg nitrogen per hectare causes further growth of *Datura stramonium* and increased dispersal and emergence percentage of seeds.

## REFERENCES

- [1] Benkman, C.W. 1995. Wind dispersal capacity of pine seeds and the evolution of different seed dispersal modes in pines. *Oikos* 12: 221-224.
- [2] Fenner, M., 2000. *Seeds: The Ecology of Regeneration in Plant Communities*. Wallingford, U.K., CABI Publishing. P. 350.
- [3] Foley, M. E., 2002. Introduction to the symposium on dormancy in seeds and vegetative propagules. *Weed Science*. 50: 214-223.
- [4] Hamada, Y. 2007. Detecting Tamarisk species (*Tamarix* spp.) in riparian habitats of Southern California using high spatial resolution hyperspectral imagery. *Remote Sensing of Environment* 109: 237-248.
- [5] Hejcman, M., Kristalova, V., Cervena, K., Hrdlickova, J. Pavlu, V., 2012. Effect of nitrogen, phosphorus and potassium availability on mother plant size, seed production and germination ability of *Rumex crispus*. *Weed Research*. 52: 260-268.
- [6] Holm L., Doll, J., Holm, E., Pancho, J., Herberger, J., 1997. *World Weeds: Natural Histories and Dispersal*. In: *Datura stramonium* L., Wiley, New York, USA.
- [7] Howard, C.L., Mortimer, A.M., Gould, D., Putwain, P.D., Cousens, R., and Cussans, G.W. 1991. The dispersal of weeds: seed movement in arable agriculture. *Proceedings Brighton Crop Protection Conference-Weeds*, p. 821-828.
- [8] Jacobs, B. S., Lesmeister, S. A., 2012. Maternal environmental effects on fitness, fruit morphology and ballistic seed dispersal distance in an annual forb. *Functional Ecology*. 26: 588-597.
- [9] Kumawat, P.D., Jat, N.L., and Yadavi, S.S. 2006. Effect of organic manure and nitrogen fertilization on growth, yield and economics of barley (*Hordeum vulgare*). *Indian Journal of Agricultural Science*. 76: 226-229.
- [10] Romermann, C., Tackenberg, O., Poschlod, P. 2005. How to predict attachment potential of seeds to sheep and cattle coat from simple morphological seed traits. *Oikos* 110: 219-230.
- [11] Sayyed A., Shah M. 2014. Phytochemistry, pharmacological and traditional uses of *Datura stramonium* L. review. *Journal of Pharmacognosy and Phytochemistry*. 2 (5): 123-125.
- [12] Saeidi, G. 2008. Effect of some macro and micronutrients on seed yield and other agronomic traits of sesame in Isfahan. *J Weed Seed Sci*. 45: 379-390.
- [13] Sanchez, R.A., Soriano, A. and Slabnik, S., 1966. The interaction of the seed coat and gibberlic acid in the germination of *Datura ferox* L., *Canad J Bot*. 45: 371-376.