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DIFFERENT PLANTING PATTERNS AND TRANSFERRING TIME OF BLACK ZIRA BULBS FROM NURSERY TO THE FARM (*BUMIUM PERSICUM.* BOISS)

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ABSTRACT

This study was done to investigate the effects of black zira bulb transfer time from the nursery to the appropriate planting pattern of black zira bulbs at Agricultural Research Center of Khorasan – station September 1997. The nursery experiment was carried out under a randomized complete block design with a factor as the amounts of seed treatments at four levels (20, 60, 100, 140, 180 and 220 kg seed/ ha) at 13 cm row spacing. The second field was prepared for the planting patterns experiment prior to bulb transferring time in July 1999. It was conducted in the form of factorial (planting patterns including square, rectangle and diamond) × bulb transfer time of two years old from the nursery to the field (6/7/99, 6/10/99 and 6/1/00) at a randomized complete block design with four replications. The row spaces were considered 25 cm in the rectangular model and diamond and 12.24 cm in square model. Using the black zira seed rate of 60 kg per hectare in the nursery was the suitable seed rate to achieve the best bulb size and two-year bulb product of black zira. The best time of transferring for black zira bulb is during sleep time in the summer before tuber emergence and active phase. A rapid rise in bulb diseases and bulb were observed when the bulbs was transferred late in fall and winter due to they were injured by the impact of the mechanical activities of transferring at time of bulb emergence. When bulbs were transferred from nursery to the field in the summer, they produced more yield than late bulb transferring. There was no observed any significant difference between the planting patterns.

KEYWORDS: Bunium persicum, plant density, rectangular,diamond, square, bulbs.

INTRODUCTION

Black zira (*Bunium persicum*.Boiss) is one of the important medicinal plant that rows in mountainous regions and they has been used in the far distant past. It is a high value herbaceous spice widely used for culinary, flowering, perfumery and carminative purposes. It is known worldwide for its medicinal value as Ibn Sina and Heravi have been mentioned some of pharmacological characteristics of black zira in their great scientific paper work. In addition to the medicinal properties of black zira, it has been used to make food testy with good smell. Aromatic compounds (14.6%) and essential oils (8.75%) are the major chemical compounds of *B.periscum* and carvone (44%) is the main component of the essential oil in black zira. Besides, being a source of essential oils rich in terpenoids and phenylpropanoids, polyene and phototoxic furanocoumarins are typical of this family(Sofi and Singh 2009).

It has received very little attention in terms of development, standardization of production technology, and plant protection management practices. A few experiments have been already done on some agronomic parameters of The optimum seed rate of black zira is 100 and 60 kg per hectare to produce the highest bulb yield with suitable bulb diameter for one year old bulb and two years old bulb in nursery, respectively (Faravani and Rahimian Mashhad 1998). In other studies showed the best planting date in the climate of Mashhad is fall under stripe sowing methods to achieve a high number of green plants of black zira (Khosravi 1993).

Considering the fact that black zira plant does not go for flowering until the third and or fourth, thus using nursery can provide more care in small planting area with low expense from seed establishment till bulb transferring to the field after two years and it is easy to transplant black zira bulbs in the field with the optimum density and planting pattern to produce a high seed yield for 8-9 years (Khosravi 2005; Sofi and Singh 2009). The low productivity is mainly due to poor crop management practices, inadequate planting density, high weed incidence, disease, insect damage, and lack of nutritional processing techniques.

The aim of this experiment is to achieve suitable planting pattern and plant density of plant density in the field.

Ecology of Black zira : *Bunium persicum* is a perennial herbaceous plant and It is native to mountains areas in eastern Iran, especially Khorasan and Kerman, but it is scattered in other provinces of Fars, Hamadan, Tehran, Mazandaran and Semnan (Omid Beigi 1997; Khosravi 2005; Sofi and Singh 2009). It is habited to grow in other countries like Pakistan, India and Central Asia.

This plant is propagated by seed at the end of vegetative stage after 2-3 years. Seed is scattered in the environment and germinate after passing the cold winter with two cotyledon leaves and produce small bulb roots in the first year. This bulb is grown to produce the bigger bulbs and adding the bulb weight in the following years, so that they are inactive form during the summer until late winter, in spring, they begin the active phase with rosette leaves in the second year. The reproductive stage and flower formation will be begun when the bulb gets weight about 2

grams that it is happened in the third years old plant in early May. Black zira is able to keep a economic seed production for 8-9 years with an average 700 kg of seed per hectare depending on the climate and soil conditions(Khosravi 1993; Dar and Zeerak 2010). A cold stratification is required by Black zira seed before germinating, as a series of seed treatments has been already tested in different temperatures at 3 to 5° C for 20 days, the best germination was obtained alter stratification for 46 days. The best seedling development occurred if the seedlings had radicles 3 to 5 mm long before transplanting and if the transplants were placed in a soil mixture consisting of clay-loam soil, sand, leaf mold, and peat. Optimum seedling growth occurred at 10 to 25° C. The seed dormancy is because of ABA amount in black zira (Bonyanpour and Khosh-Khui 2001).

MATERIALS AND METHODS

This study was consists of two separate experiments as the effects of different amounts of black zira seed, three bulb transfer time and planting patterns square, rectangular and diamond . They were carried out in nursery and filed under randomized complete block design with four replications as follows.

1 – Determining the optimum seed rate for planting in nursery:

First to compare the different amounts of black zira seed with 6 levels 20, 60, 100, 140, 180 and 220 kg per hectare were used in nursery under a randomized complete block design with four replications in 1997. The area of each plots was 15 m square, before planting the soil profile to 30 cm depth was measured and then Sonalan herbicide was applied against weeds at the same time fertilize were performed as 25 tons of manure, 90 N, 30 P2O5 and K 30 kg per hectare. Samples were taken from two years bulb in the summer of 1991.

2- Determining the appropriate pattern and the best transfer time of bulbs from the nursery to the field:

Like before the soil profile to 30 cm depth was measured and other agricultural operations were conducted like the first experiment. Plots with dimensions of 2.5 × 3 m were prepared and planting treatments including planting patterns (square, rectangular and diamond) with three transfer time 06/07/99, 06/10/99 and 06/01/00) were conducted in the form of a randomized complete block design with four replications. In order to evaluate the bulb diameter and the number of two-years bulb, sampling was performed in every area of one square meter plot after separating bulbs from the soil . Measurements were done on the number of 30 on two years old bulbs.

TABLE-1. Soil chemical and physical Analysis

Soil texture	Soil texture	Potassium availability	Phosphor availability	Carbon %	Total nitrogen	PH	EC
Loam	Loam	410	17.6	6.51	64	7.8	4.13

Black zira seeds was incubated with ratio 1.5 in a thousand of fungicide (Thiram+Carboxin) before planting and planted in early autumn 1997. The two-year old bulb was harvested from the soil in the summer 1999. The first irrigation was taken after planting in late November and the next irrigation treatments were combined with complementary nitrogen fertilizer. Various agronomic and morphological traits of vegetative period was measured until flowering in late June. The margin plots were removed after physiological maturity and then they were harvested. Characters such as the number of main branches, plant height, number of umbel, umbrella number in umbel, number of seeds per umbrella, seed weight and biomass per plant on 30 plants, seed yield and biological yield were measured during the years 2002 then the achieved data were analyzed by statistical tests.

RESULTS AND DISCUSSION

The optimum seed rate for planting in nursery

Analysis of variance showed that there was a significant differences ($p<0.05$) between the used seed rates at nursery in the point of number, weight and bulb diameter , but there was no significant difference for the yield of two-years old 's bulb (Table 2). The results of Duncan test also showed that the seed rate 60 kg ha was the best rate to produce two years old's bulb with the highest number of bulbs and bulb weight (3). Studies showed the larger bulb roots (diameter greater than 5.5 cm) produce more primary branches, larger umbel and umbrella, more seed number / umbrella in compare with smaller bulb roots (diameter less than 5 / 4 cm). Lager bulb root produced seed 32.9 % more than smaller bulb roots (Khosravi 1993).

TABLE- 2. The results of analysis variance for two years old are bulb roots production of black zira in the nursery in different seed rates.

S.O.V	Degree of freedom	Number of bulb roots m^{-2}	Bulb root weight (gr)	Bulb roots weight (gr. m^{-2})	Diameter of bulb root
Replication	3	272980.3750*	0.362	5928.449	0.047
Treatment	5	456167.5420**	0.597*	50062.194	0.067
Error	15	69295.808	0.142	23777.445	0.015

TABLE- 3. The result of the Duncan's Multiple Range Test (p<015) for different measured characters of two years old's bulb roots in Black zira.

Seed rates ($Kg.ha^{-2}$)	Number of bulb roots (m^{-2})	Bulb root diameter (cm)	Bulb root weight (g)
20	338.8 c	1.607 a	1.882 a
60	625.8 bc	1.415 b	1.260 b
100	874 ab	1.403 b	1.140 b
140	981 ab	1.440 b	0.875 b
180	1103 a	1.275 b	0.900 b
220	1272 a	1.350 b	0.880 b

Determining the appropriate pattern and the best transfer time of bulbs from the nursery to the field: Different planting pattern including square, rectangular and rhombic was not significantly effect on seed yield of black zira (Table 4). Considering the black zira plant has a good capacity of compressibility to adjust its canopy, therefore there was not observed any significantly effects resulting from application of these patterns on yield and its components.

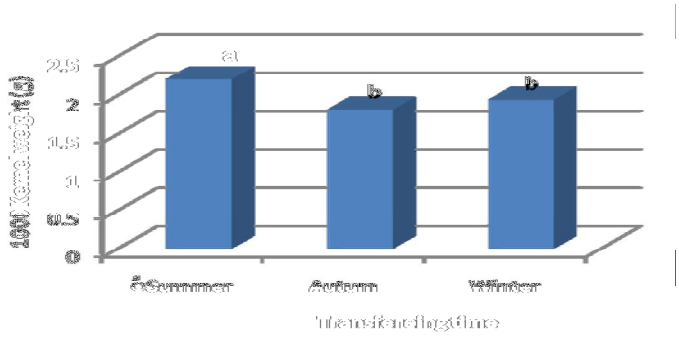
Seed yield: The highest seed yield was obtained from the two years old's bulb roots that they have already transferred during inactive form of the bulb roots in summer. When they were transferred later in autumn and winter seasons, they were injured and infected with diseases. Seed yield was reduced significantly in the late transferring because of low 10000 kernel weight in late transferring (Fig.1).

TABLE- 4. Estimation of planting pattern and transferring time from nursery to the field on some agronomic characters in black zira

Source of variation	Degree of freedom	Biological yield	% Emergence	Seed per umbrella	Umbrella number	Umbel number	Plant height (cm)	1000 Kernel weight (g)	Seed yield ($kg.ha^{-1}$)
Replication	3	147.469	0.5376	1.778	1.074	1.359	0.769*	0.008	52.441
A(Time of transferring)	2	5769082*	*2.195**	12.028	0.528	15.146	43.028	0.465	3229.799**
B (planting pattern)	2	1455.658	0.495	7.528	2.028	29.521	4.361	0.075	517.63
A×B	4	1176.583	0.315	43.111*	0.444	47.913*	32.819	0.060	418.397
Error	24	984.717	0.479	*5.697*	2.574	15.546	44.081	0.050	350.169
CV		19.56	13.57	11.58	8.04	23.72	11.68	11.35	24.81

* and ** show the significant level at p<0.05 and p<0.01 respectively

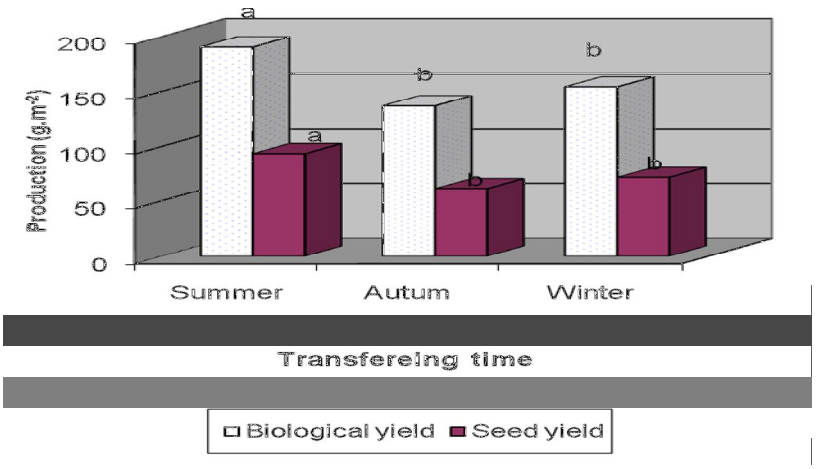
FIGURE-1. Effect of different transferring times of bulbs from nursery to the field on 1000 kernels weight (g)



The weight of 1000 kernels*:* ANOVA table showed that seed weight affected by planting at different dates. The highest seed weight was observed since the summer transfer, while the planting pattern was significantly (p<0.05) not treated on any agronomic characters of black zira (Table 3 and Figure 1).

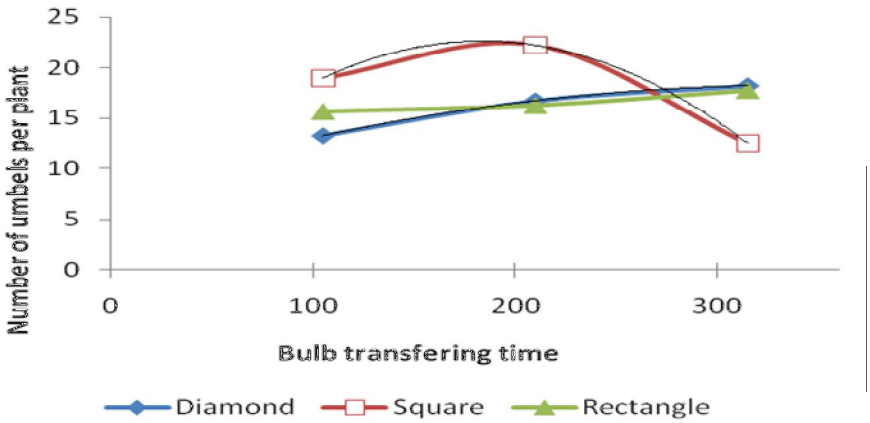
Biological yield: the highest biological yield was observed in transferring of bulbs in the summer time. They are in the inactive form at the time of transferring therefore the lowest injured bulbs with the highest percentage of emergences were resulted for the summer transferring. This was caused to increase the biological yield (Table 3and Figure 2).

FIGURE- 2. The trend of the biological yield and seed yield in different transferring times of bulbs from the nursery to the field.



Other yield components such as the number of umbels, umbrellas, seeds and plant height were not significantly ($p<0.05$) affected by the used factors in this study, but the interaction of transferring and planting pattern was significantly ($p<0.05$) treated the number of seeds per umbrellas and the number of umbels (Table 3). The highest number of umbels of black zira bulb roots was observed from transferred bulbs in autumn under square pattern. The relationship between the planting patterns and the time of bulb transferring for the number of umbels was significantly differences at $p<0.01$ in a type of secondary function in square pattern with R2= 0.73. This interaction was also chanced the number of seed per umbrella at significantly $p<0.5$. (Tables 4 , 5 and Fig.3).

FIGURE-3. Regression model for the number of umbels per plant in different bulb transferring time and planting patterns.



Among the study of planting patterns, the minimum number of seed per umbrella was observed in square pattern during transmission in autumn, whereas it was highest in the summer transmission time with a R^2=0.70, $p<0.01$. In rectangle pattern, the highest number of seed per umbrella was obtained ($p<0.05$) at the bulb transferring in autumn (Tables 4, 6 and Fig.4).

Table- 5. Testing of regression equations for the number of umbels in different planting patterns**.**

Models	Planting patterns	DF	Rsq	b2	b1	b0	sigf	F
Linear	Rectangle	10	0.081	-	0.0161	12.5833	0.37	4.88
	Diamond	10	0.317	-	0.0286	12.4167	0.57	4.65
	Square	10	0.232	-	-00.0155	18.75	0.113	3.02
Un linear	Rectangle	9	0.237	0.0004	-0.1387	26.1250	0.95	0.237
	Diamond	9	0.391	0.0002	-00.0667	20.75	0.108	2.89
	Square	9	0.731	0.0004	0.1417	5.00	0.003	12.21

FIGURE-4. Regression trend of the number of seed per umbrella among different bulb transferring time and planting patterns.

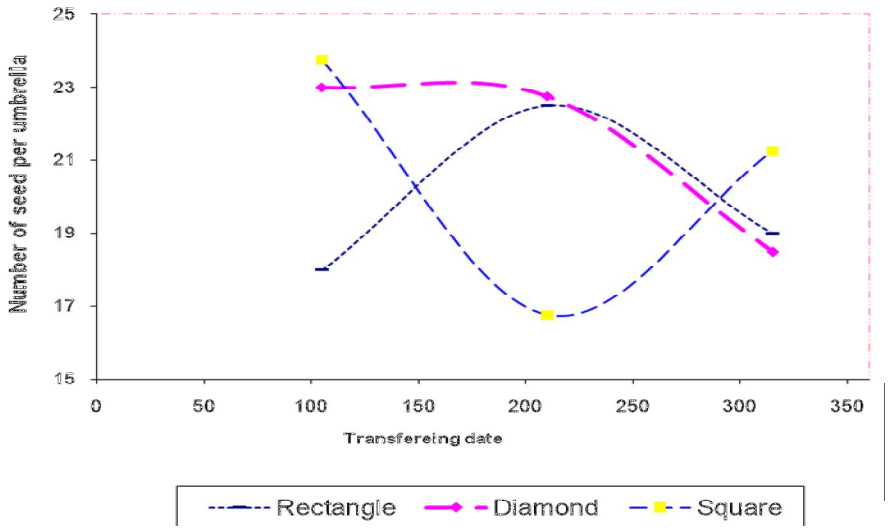


TABLE- 6. Testing of regression equations for the number of seeds per umbel in different planting patterns.

Models	Planting patterns	DF	Rsq	b2	b1	b0	Sigf	F
Linear	Rectangle	10	0.029	-	0.0048	18.833	0.599	0.30
	Diamond	10	0.314	-	-0.0214	25.9167	0.58	4.58
	Square	10	0.87	-	0.0119	23.0833	0.351	0.96
Un linear	Rectangle	9	0.641	0.0004	0.157	5.50	0.010	8.04
	Diamond	9	0.397	-0.0002	0.0548	19.25	0.103	2.96
	Square	9	0.704	0.0005	-0.231	42.25	0.004	10.72

CONCLUSIONS

According to the achieved results, the most suitable seed rate indirect planning through nursery is 60 kg and Summer season is the best time to transfer the two years old bulbs of black zira to produce the highest seed yield in the rectangular patterns.

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