

## Iranian Onion (*Allium cepa* L.) Cultivars Responses to Inbreeding Depression

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**Abstract:** Onion is an important vegetable in Iran. Its cultivation area and total production is 50000 ha and 2 Mtonnes respectively. This research was conducted for studying of Iranian onion breeding capacity for hybrid seed production at 2007-2008. Mother bulbs of three onion cultivars namely Kashan White, Dorche Isfahan and Red Rey were planted in the field. Seeds obtained from selfed and open pollinated umbels were used to measurement of inbreeding depression. There was significant different between pollination methods and cultivars in all traits. Selfing significantly caused depression in all traits except seedling length. Among cultivars, Red Rey was the most tolerant to inbreeding depression.

**Key words:** Onion • Seed • Inbreeding Depression • Cultivar

### INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important vegetables from economic and health aspects in Iran. This crop is cultivated in about 50000 ha and its total production is 2 Mtonnes [1]. Iran is probably one of onion origins in the world. This crop has many native cultivars in Iran at white and red groups. Hybrid seed production is one of the most important breeding subjects in Iran [2]. Onion is predominately a cross pollinated crop, however, there is no self incompatibility problem and protandry does not prevent of self pollination [3]. In onion umbels seed setting and development are markedly affected by availability of insects and genetic make up of the plant [4]. Onion hybrid seeds have many advantages as maturity uniformity, high yield, high quality and earliness [5]. The first step in hybrid seed production is knowing of cultivar responses to selfing and inbreeding depression rate of inbred lines. Inbreeding depression can be seen in seed and seedling traits as umbel seed weight or seedling fresh weight. So this research is one of the most important topics at Iranian onion breeding.

### MATERIAL AND METHODS

This research was conducted in Karaj at 2007-2008. Mother bulbs of three onion cultivars namely Kashan White, Dorche Isfahan and Red Rey were produced by

seed planting of cultivars in May of 2007. Then bulbs were selected and replanted at December of 2007 in three plots. Each plot had 20 rows, distances between rows and plants on the rows were 60 and 30 cm respectively. Length of rows were 6 m. Normal cultivation operations were done regularly in the field. After bud formation, during April-May 2008, 30 individual umbels in each of three cultivars were selfed by covering them with paper bags (15×20 cm) before anthesis. Other umbels left open to produce open pollinated seed. When umbels showed at least 60 percent black seeds in July, they were harvested. Selfed and OP seeds (15 umbels of each group) were collected separately. Then seed traits as umbel seed weight, % germination, seedling length and seedling fresh weight were recorded. For recording seedling traits, seeds were planted in petri dishes under laboratory conditions at a temperature of 20 °C with 16 hours photoperiod. Germination percent was recorded after 14 days of seed sowing [6].

Inbreeding depression was calculated by Peterson [7] formula as:

$(\text{open pollinated} - \text{self pollinated} / \text{open pollinated}) \times 100$

The experimental design of research was factorial in CRD base in 5 replicates. The factors were cultivar and pollination method. Data analysis were done by MSTATC software and mean comparisons method was Duncan.

Table 1: Analysis variance of traits

S.O.V	D.F.	MS			
		Umbel Seed Weight	Germination percent	Seedling Length	Seedling Fresh Weight
Pollination method (A)	1	197.008 **	21.412 **	0.127 ns	0.915 **
Cultivar (B)	2	4.767 **	11.561 **	0.859 *	0.050 *
A×B	2	4.397 **	5.485 *	3.313 **	0.050 **
Error	24	0.279	1.072	0.210	0.049
CV (%)		17.58	14.87	14.02	23.35

\*, \*\*, ns: respectively significant difference at 5 and 1% level and no significant difference

Table 2: Mean comparisons of traits in pollination methods

Pollination method	Umbel Seed Weight (g)	Germination percent	Seedling Length (cm)	Seedling Fresh Weight (g)
Selfing	0.439 b	57.44 b	11.10 a	0.60 b
OP	5.564 a	80.98 a	10.25 a	1.26 a

Table 3: Mean comparisons of traits in Iranian cultivars

Cultivar	Umbel Seed Weight (g)	% Germination	Seedling Length (cm)	Seedling Fresh Weight (g)
Kashan White	3.393 a	83.36 a	10.55 ab	1.006 a
Dorche Isfahan	3.407 a	70.53 a	12.73 a	0.956 a
Red REy	2.205 b	53.91 b	8.89 b	0.755 b

Table 4: Inbreeding depression rates of traits

Cultivar	Umbel Seed Weight			Germination percent			Seedling Length			Seedling Fresh Weight		
	Selfing	OP	ID	Selfing	OP	ID	Selfing	OP	ID	Selfing	OP	ID
Kashan White	0.148	6.639	97.7	55.07	85.67	35.71	7.49	14.14	47.03	0.689	1.383	100.72
Dorche Isfahan	0.887	5.928	85.03	50.12	96.19	47.9	8.58	17.69	106.17	0.536	1.498	64.22
Red REy	0.283	4.126	93.14	45.54	62.54	27.2	8.49	9.30	9.54	0.583	0.952	38.76

## RESULTS AND DISCUSSION

The results of analysis variance of traits) showed all traits except seedling length had significant difference in pollination methods. Cultivars and reciprocal effects of factors had significant difference in all traits (Table 1).

Open pollination method significantly increased umbel seed weight, germination percent and seedling fresh weight, but seedling length was unique in both pollination methods (Table 2). Among cultivars, Red Rey was significantly in low rank (Table 3).

Inbreeding depression rates was shown in Table 4. Inbreeding depression of traits results showed that selfing has caused depression in all traits and in all cultivars. In Red Rey cv inbreeding depression rates in all traits is lower than other cultivars. Therefore, it can be said selfing (inbreeding) has the least effect in this cultivar. Therefore, in Kashan White and Dorche Isfahan cultivars because of expression of recessive alleles and homozygosity of them by selfing are mostly intolerant to inbreeding. In result for hybrid seed production

development of inbred lines in Red Rey cultivar will be successful (Table 4).

Results of this research totally showed the OP method was higher than selfing in most traits. Also inbreeding depression was observed because of expression of recessive alleles of traits. This findings verifies Jones and Davis [8] and Gablman [9] reports about inbreeding depression effects in onion. The variation of cultivars in different seed and seedling traits is because of genetic differences between cultivars. Aminkhan *et al* [6] also reported inbreeding depression at Paketanian onion cultivars at Feysal Abad.

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