

Comparison of *Vicia villosa* establishment under different cultivation seasons and methods in the Homand Absard Research Station

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Received: 22 January 2018; Received in revised form: 15 October 2018; Accepted: 30 March 2019

Abstract

Homand Absard Rangeland Research Station is located 70 km northeast of Tehran and 15 km southeast of Damavand with an altitude of 1972 m a.s.l., an average annual rainfall of 333 mm, and a cold semi-steppe climate. In order to compare the seed production of *Vicia villosa* under different cultivation seasons and methods, the seeds were initially collected from natural habitats similar to the mentioned station. Afterwards, seed characteristics such as viability, and seed vigor were examined. Two sowing methods, namely row seeding and seeding with rainfall storage, through crescent contour trenches and spring and autumn sowing dates, were considered in a complete randomized block design with three replications. Statistical analysis was performed by independent t-test using SPSS 21 software. According to the obtained results, no establishment was recorded for spring sowing; furthermore, in autumn sowing, the two cultivation methods were not significantly different in terms of establishment ($P < 0.05$). However, the results of mean comparisons showed that in autumn sowing, the crescent seeding with an average seed production of 68.36% was superior to the row seeding with an average seed production of 59.12%.

Keywords: Establishment; Cultivation method; *Vicia villosa*

1. Introduction

A major problem associated with the rangelands of Iran is their large areas of poor and very poor soil quality. In such areas, the production has been reduced due to the continuation of non-normative uses. Moreover, their natural regeneration is either not possible or occurs occasionally over prolonged periods due to the degradation of genomic resources. It is particularly important to study the development and cultivation methods of rangeland native species for forage production and rangeland conservation, especially in low-yield rainfed fields. Such studies are socially and economically justified because the obtained results are used by the beneficiaries of rangelands to produce suitable seeds. The main objective of the present study was to investigate

native range species for range improvement and familiarity with seed propagation techniques of range species, production of certified seeds for range improvement practices, establishment methods, and to understand the problems of the seeds whose germination faces many difficulties. This study is based on the hypothesis by comparing different methods of cultivation, it is possible to reach a cultivation and establishment method through which, in addition to reasonable success in seed production, degraded low-yield rangelands are conserved, and economically desired results could be obtained with lower costs. Several studies have been done on the subject both inside the country and abroad; the most important of these studies are as follows:

Peimanifad *et al.* (1996) compared different accessions of perennial alfalfa (*Medicago*) at Homand Absard Rangeland Research Station. They concluded that in terms of forage production, Bonab cultivar was superior to other cultivars. Ashig (1995) reported that flat sowing

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produced higher seed yields as compared to ridge sowing. Akbarzade and Salari (1996) compared the forage production of different cultivars of onobrychis under rain-fed conditions in Urmia. According to their findings, the highest and lowest forage production pertained to Shahrekord (2136 kgha-1) and Sabzevar (1217 kgha-1) cultivars, respectively. Gasriani (1997) conducted a study in the Kharkeh Research Station of Kordestan province, concluding that 14 Kg/ha was the suitable amount of seed for a better establishment of *Medicago rigidula*. Farouk *et al.* (1987) reported that late sowing reduced plant disease. Pilbeam *et al.* (2000) observed that late sowing caused a reduction in the yield. Akbarzade (2002) examined five annual species of *Medicago* and concluded that *M. radiata* and *M. rigidula* in spring and autumn cultivations were superior in terms of seed and forage production, respectively. Ayob *et al.* (2008) evaluated the effect of four sowing methods (broadcast, ridge sowing, line sowing, and bed sowing) on the growth and yield of Fennel sown on three different dates. They reported that the line sowing of Fennel in mid-October seemed to be the most optimal combination for obtaining higher fennel seed yields. Mirhaji (2009) assessed nine range species, including grasses and legumes at Homand Absard Station for four years and observed significant differences among the measured traits of accession. Additionally, different cultivars of alfalfa (52) were evaluated, and among domestic and foreign cultivars, Krisari cultivar (2122) was identified as the best in terms of forage production. Wen-long *et al.* (2010) showed that the sowing date of *Vicia villosa* could significantly affect the growth period of plants. Early sowing increased the plant growth period. However, the seed yield increased and then decreased with the delay in the sowing. Yu-min *et al.* (2010) showed that delayed sowing significantly reduced the fresh grass production capability of *Vicia villosa*. Nooshkam *et al.* (2010) investigated the effect of plant density and planting time on seed yield and quality of Egyptian clover (*Trifolium alexandrinum* L.). They showed that late sowing led to reduced yields, seeds, and protein while increasing the fiber of this species. Teasdale *et al.* (2014) reported that planting delayed by two to three weeks reduced hairy vetch (*Vicia villosa*)

biomass by 43% when harvested at the vegetative stage and by 20% when harvested at flowering. Fıncıoğlu (2014) compared six vetches (*Vicia* spp.), represented by 96 accessions, for developmental rate, herbage yield, and seed yield in semi-arid central Turkey (1995-98). He observed that the growing period was curtailed by summer drought in the first growing season (Y1), and by heavy rainfall in the second (Y2). In the third season (Y3), conditions were more temperate. *Vicia pannonica* ssp. *pannonica* (Pan) and *V. villosa* ssp. *villosa* (Vil) produced more biomass in Y3 compared with Y1 and Y2; however, *V. pannonica* ssp. *purpurascens* (Pur) and *V. villosa* ssp. *dasycarpa* (Das) produced more biomass in the wetter Y2. In the shorter growing seasons (Y1 and Y2), the earliness of Pur and Das resulted in high seed yields. *V. narbonensis* (Nar) in Y3 was particularly sensitive to the widely fluctuating air temperatures with the accompanying heavy rainfalls at the vegetative stage. This resulted in vigorous vegetative growth, hindered flowering, and reduced seed yield. In *V. sativa* ssp. *sativa* (Sat), biomass and seed yield were significantly increased by the longer period of favourable growing weather during Y3. In agricultural practice, Pan and Vil have a great potential for herbage production and grazing, Pur, Nar, and Sat for grain and straw production, and Das for both hay and grain crops.

2. Materials and Methods

2.1. Location and characteristics of the study area

Homand Absard Rangeland Research Station is located 70 km northeast of Tehran and 15 km southeast of Damavand between a longitude of 52° 15' 25" E and a latitude of 35° 4' 9" N. The study area has an altitude of 1972 m a.s.l. and an average annual rainfall of 333 mm with a cold semi-steppe climate. It has a frost period of 120 days and a drought period of four months. The warmest and coldest months of the year are July (22.8 °C) and January (-3.2 °C), respectively. The soil of the station is brown in color, containing a great amount of lime in lower layers (80-100 cm). The soil is poor in organic matter with a pH of 7.7 and a heavy soil texture (clay loam) (Figure 1).



Fig. 1. The view of Hoomand Absard Research Station

2.2. Sampling

Primarily, the seeds were collected from natural habitats, which were similar to the studied station, in late June and early July, and the viability and vigor of the seeds were

examined. We considered two sowing methods, namely row seeding and seeding with rainfall storage, through crescent contour trenches and spring and autumn sowing dates, in a complete randomized block design with three replications (Figure 2 to 4) .



Fig. 2. Crescent planting method of *Vicia villosa* at Hoomand Absard Research Station



Fig. 3. Row planting method of *Vicia villosa* at Hoomand Absard Research Station



Fig. 4. *Vicia villosa* spring weed operation at Hoomand Absard Research Station
Statistical analysis

Statistical analysis was performed by independent T-test using SPSS 21 software.

3. Results

According to the obtained results, no establishment was recorded for spring sowing; in addition, in autumn sowing, the two cultivation methods had no significant differences regarding establishment ($P < 0.05$) (Table 1).

There were no significant differences between the two cultivation methods; however, the mean comparisons of establishment percentage were measured, and the results showed that in autumn sowing, a higher seed establishment was recorded for the crescent seeding with an average of 68.36 % as compared to the row seeding with an average seed production of 59.12 % (Fig. 5).

Table 1. Comparison of *Vicia villosa* establishment in Homand Absard Research Station under two sowing methods in autumn

		Independent Samples Test								
		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	t	df	Sig.	M D	S.E	95% Confidence Lower	Upper
Establishment	Equal variances assumed	2.85	.167	.366	4	.733	9.24	25.22	-60.78	79.27
	Equal variances not assumed			.366	2.954	.739	9.24	25.22	-71.74	90.22

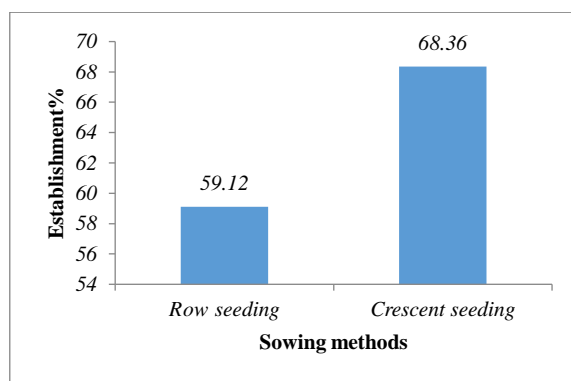


Fig. 5. Comparison of *Vicia villosa* average establishment in autumn under two sowing methods in Homand Absard Research Station

4. Discussion

Our results clearly showed that no establishment percentage was recorded for

spring sowing; also, in the autumn sowing, the two cultivation methods had no significant differences in terms of establishment. Furthermore, the results of mean comparisons

showed that in autumn sowing, higher establishment was recorded for the crescent seeding with an average of 68.36 % as compared to the row seeding with an average establishment of 59.12 %. The reason might be the greater use of autumn rainfall and optimum storage in crescent-shaped contour trenches. In this context Anderson *et al.*, (1949) also emphasized the need to use methods to provide the water needed for pastures that are regenerated by seed. Additionally, it seems that if rainfall continues in spring, it is possible that flowers and seeds be produced in spring sowing, particularly in crescent-shaped contour trenches. Beadle (1948) came to a similar conclusion, reporting that furrows increased water infiltration into the soil, caused more soil-seed contact, reduced the wind speed, and controlled the water flow. Sanadghol and Malkolm (1995) showed that by increasing the depth of furrows, more water was stored, and where natural vegetation was not sufficient, plowing was superior to pitting. Also, Plumer *et al.*, 1955, in Utah and Nevada, southern Idaho and Western Wyoming, has reported good results in wetland cultivation in early spring and dry land in autumn. Nonetheless, this result was contradicted by the findings of Ayob *et al.*, (2008) who reported the line sowing of Fennel in mid-October was seemingly the best combination for obtaining higher fennel seed yields. Moreover, Ashiq (1995) reported that flat sowing produced higher seed yields and establishment compared to ridge sowing. The results obtained in the studied station for *Vicia villosa*, belonging to the Leguminosae family, were different from that reported by Mirhaji (2009) for the three grasses, namely *Ag. desertorum*, *Ag. elongatum*, and *Bromes tometellus*, indicating that surface sowing was more appropriate than deep sowing and seeding.

5. Conclusion

Autumn sowing and crescent method are recommended for the establishment of *Vicia villosa* at Homand Absard Rangeland Research station and similar regions.

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