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Research and Short Length Article:

Effects of Sowing Season and Method on Seedling Emergence and Survival Rate of *Vicia variabilis* in Kermanshah, Iran

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Abstract: This study aimed to evaluate the sowing season and sowing methods for *Vicia variabilis* using split plot design based on completely randomized block with three replications in Meleh-Kabud, Gahvareh, and Kermanshah, Iran during 2016-17. The first factor was sowing season (spring and autumn) and the second one was sowing method (row sowing and scatter sowing). Result showed that sowing method had a significant effect on seedling emergence percent ($P<0.01$). Means of this trait were 19.96% and 2.61 at row sowing and scatter sowing, respectively. Similarly, effects of both factors and their interaction were significant on survival rate ($P<0.01$). The higher value of survival rate as 22.6% was obtained in row sowing method in spring. It was concluded that row sowing is an optimal method in early spring for rangelands improvement in Kermanshah province, Iran.

Introduction

Rangelands are the largest natural ecosystem in Iran that covers about 54% areas of country (Ariapour *et al*., 2016). However, rangelands in Iran are suffering from severe degradation factors such as overgrazing, early grazing and converting to rain-fed lands. Consequently, regeneration of valuable plant species has been the main concern among researchers of rangelands in Iran.

The *Vicia spp.* is one of the important annual forage legumes comprising approximately 190 species over the world (Erik and Tarikahya, 2004). Legumes are quite different from other plant species in certain features such as N_2 fixation capacity, and protein richness (Varshney *et al.,* 2015). They are also vital for forage production and soil conservation and subsequently rangeland rehabilitation in Iran due to fast root development and tolerance against frost and drought stress (Azhir and Fayaz, 2018). Moreover, the nutritional value of some species in this genus is the same as alfalfa with a crude protein of about 29.3% (Razmazar *et al.,* 2012). As a result, *Vicia, spp.* can be considered for degraded rangelands in semi-arid regions in some parts of Iran. Considering the fact that some parts of Iran rangelands are annually subjected to N chemical application (Badripour, 2006), range areas in Iran are estimated to be about 86 million ha out of which 25 m ha are subject to range management planning (Ariapour *et al.,* 2016). This issue was considered by researchers focusing on regeneration rate, season and method of planting. The study conducted by Akbarzade and Adisho (2001) showed that the seedling emergence appearance of annual legumes such as *Medicago spp* are also affected by sowing season in spring and autumn depending on their varieties and native location (Akbarzadeh and Adisho, 2001).

A study conducted by Paimanifard *et al.* (1981) explored the advantage of some native legumes in terms of germination, survival and forage production. Furthermore, they assessed different seed sowing methods for range rehabilitation in Iran. A study done by Mirhaji *et al.* (2012) showed that shallower seed planting causes higher level germination for some grass species. In contrast, in dry areas where soil is consisted of sand and sandy loam, relatively deeper seed planting is preferred due to soil moisture storage for germination process (Sanadghol and Malakpoor, 2002). Soil moisture is the key factor affecting *Vicia* growth and forage production. Mohebbi *et al.* (2016) found autumn as the best season for seed sowing of *Vicia villosa* in Damavand, Iran.

The objective of this study was to evaluate the effects of sowing methods and seasons of cultivation on seedling emergence and survival for *Vicia variabilis* in rangelands of Gahvareh, Kermanshah Province, Iran.

Materials and Methods
The study Area

This study was conducted in the rangelands of Dalahoo located in Meleh-Kabud, Ghahvareh, west of Iran (36° 29′ 56″ E, 34° 24′ 42″ N). These summer rangelands are dominated by shrubs, forbs and grasses. The mean annual rainfall and temperature are 500 mm and 14°C, respectively. The average altitude is 1700 m above sea level. Winters are cold enough to drop below zero during December, January, and February. Summers are, however, relatively cool and dry indicating a semi-arid region. Furthermore, mean annual rainfall in the site was 687 and 616 mm during 2016 and 2017, respectively.

Methods

The native seeds of *Vicia variabilis* were collected in rangelands with similar conditions (topography, climate and vegetation) in Kermanshah Province. The seeds were subject to germination test in

laboratory following standard methods (Bewley and Black, 1994). Finally, seeds with high germination percent (83%) were selected for cultivation.

The experiment was performed in split plot arrangement using completely randomized block design with three replications. Main plots were assigned to sowing season (spring and autumn) and sub-plots consisted of two methods (row sowing and scatter sowing). The size of each plot was 12.5 m^2 (5×2.5 m) with 0.5 m interval. The required seeds were planted in 3 cm soil depth using 10 kg/h. In the first and second years, data were collected for seedling emergence percent and survival rate.

The collected data were subjected to analysis of variance and means comparison was done using Duncan test. The SAS software version 6.12 was used for data analysis.

Results and Discussion

Result of analysis of variance showed significant effect of sowing method on seedling emergence percent (P<0.01) (Table 1). Means of seedling emergence percent were 19.96% and 2.61 at row sowing and scatter sowing, respectively (Table 2).

Furthermore, statistical analysis revealed higher seedling emergence percent in spring (14.6%) than that in autumn (7.95%) (Table 3). In overall, higher seedling emergence with average value of 26.6% was obtained in spring sowing season coupled with row sowing method (Table 4). The lower value of seedling emergence percent in autumn was related to frost of winter that may damage some seedlings. Also, due to appropriate rainfall and temperature in early spring mainly April, the seeds emergence value was higher than autumn. Similar to our finding, Mirfakhraee *et al.* (2010) showed that *Vicia spp.* species are more vulnerable to drought stress and their germinations are significantly reduced by soil moisture deficit. Thus, seasonal rainfall is the key factor for rate of seedling appearance. In contrast to this result, in some rangelands, autumn cultivation was preferred due to considerable autumn and subsequent winter precipitation (Azhir and Fayaz, 2018).

For survival rate, the effects of sowing season and sowing method were significant (P<0.01). In addition, the sowing season and sowing method interaction was significant for survival rate (P<0.01) (Table 1).

Means of survival rate were 13.81% and 1.65% for row sowing and scatter sowing methods, respectively (Table 2). Similarly, higher survival rate was obtained in spring (14.6%) than autumn (3.00%) (Table 3). In general, higher value of survival rate as 22.6% was obtained in row sowing method in spring (Table 4). The higher survival rate in spring may occur due to soil moisture availability in spring leading to nutrients uptake and consequently vegetative growth of forage herbages.

Higher germinating rate through seed sowing was related to seed bed preparation. This was reported for some range species in Iran (Sanadghol, 2006). Restoration in semi-arid rangelands is slow and failures are common because of low and unreliable rainfall. In the semiarid rangelands, appearance and survival rates are related to cultivation methods causing the soil moisture storage (Snyman, 2003).

In overall, *Vicia spp.* is well adapted to growth in the Mediterranean environments all over the world on a variety of soil types, particularly for the recovery of retrogressed rangelands as well as cultivation under rain-fed condition in semi-arid regions (Snyman, 2003). In addition, they have good quality for animal feeding due to considerable protein and variety of amino acid (Alghamdi, 2009).

Conclusion

The *Vicia variabilis* is an annual palatable legume in semiarid rangelands while its regeneration is limited due to degradation factors such as overgrazing and converting rangelands to rain-fed areas as well as drought stress. This study showed that enhancing the regeneration and survival rate of *Vicia variabilis* depends on the seed sowing method as well as sowing time. However, the result indicated that seed sowing in early spring is the optimum time for cultivation of *Vicia variabilis*. This method of cultivation was recommended for parts of degraded rangelands which are consequently desirable vegetation such as *Vicia variabilis* diminished mainly by early grazing and overgrazing factors. Thus, the season and method of seed sowing should be considered to save this plant species. It was concluded that row sowing is an optimal method in early spring for cultivation of *Vicia variabilis* and rangelands improvement in Kermanshah province, Iran.

Table 1: Analysis of variance of sowing season and method for seedling emergence and survival rate in *Vicia variabilis*

Source of variation	DF	MS	
		Seedling emergence	Survival rate
Replication	2	0.193^{ns}	0.305^{ns}
Sowing Season(S)	1	1.668^{ns}	8.312^{**}
Error$_1$	2	0.088	0.018
Sowing Method (M)	1	21.658^{**}	17.836^{**}
S×M	1	1.610^{ns}	2.053^{*}
Error$_2$	2	0.870	0.292
CV (%)	-	9.48	12.04

*, **= Means of square are significant at 5 and 1% probability levels and non-significant, respectively

Table 2. Sowing methods (row and scatter sowing) for seedling emergence and survival rate in *Vicia variabilis*

Sowing Method	Seedling emergence %	Survival rate %
Row sowing	19.95 a	13.81 a
Scatter sowing	2.61 b	1.65 b

Means of column with similar letters are no significantly different based in Duncan method (p<0.05)

Table 3. Sowing season and method for seedling emergence and survival rate in *Vicia variabilis*

Sowing season	Seedling emergence %	Survival rate %
Spring	14.6 a	12.45 a
Autumn	7.95 b	3.00 b

Means of column with similar letters are no significantly different based in Duncan method (p<0.05)

Table 4. Sowing season and sowing method interaction for seedling emergence and survival rate in *Vicia variabilis*

Sowing season	Sowing Method	Seedling emergence %	Survival rate %
Spring	Row sowing	26.6^a	22.6^a
	Scatter sowing	2.6^c	2.3^{ab}
Autumn	Row sowing	13.3^b	5.0^b
	Scatter sowing	2.6^c	1.0^c

Means of column with similar letters are no significantly different based in Duncan method (p<0.05)

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بررسی اثرات فصل و روش کاشت در سبز شدن و زنده مانی گونه *Vicia variabilis* در مرتع ییلاقی استان کرمانشاه

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چکیده: هدف از این تحقیق تعیین بهترین زمان و روش کاشت در سبز شدن و استقرار *Vicia variabilis* در مراتع تخریب شده در منطقه مله کبود شهرستان دالاهو استان کرمانشاه می‌باشد. این تحقیق در قالب طرح کرت‌های خرد شده با تیمار اصلی تاریخ کشت و تیمار فرعی روش کشت در سه تکرار در سال‌های ۱۳۹۶ و ۹۷ اجرا گردید. فاکتور اول دو تاریخ کشت پاییزه و بهاره و فاکتور دوم دو روش بذرکاری خطی و بذر پاشی بود. آمار برداری در درصد سبز شدن و زنده مانی گیاهان در کرت‌ها انجام گردید. نتایج تجزیه واریانس نشان داد که روش کاشت اثر معنی‌داری بر درصد سبز شدن داشت. از لحاظ درصد زندمانی اثر فصل کاشت و روش کاشت و اثر متقابل فصل در روش کاشت معنی‌دار بود. نتایج مقایسه میانگین تیمارها نشان داد که میانگین درصد جوانه‌زنی در روش بذرکاری معادل ۲۲ درصد بود. همچنین نتایج تحقیق نشان داد که کشت بهار درصد جوانه‌زنی بالاتری نسبت به کشت پاییزه از خود نشان داد. نتایج تجزیه آماری در طی دو سال آماری حاکی از آن است که رابطه معنی‌داری میان زمان کشت و نوع کشت وجود دارد و بهترین فصل کشت برای زندهمانی و استقرار گونه مرتعی *Vicia variabilis* کشت بهاره و مناسب‌ترین شیوه کشت برای استان کرمانشاه کشت خطی در عمق مناسب است.

کلمات کلیدی: بذرپاشی، فصل کشت، مله کبود، کشت بهاره