Evaluation and Comparison of the Yield and Protein Content of Onobrychis Visifoliya in the Spring and Autumn Plantings, Case Study of Arsanjan

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Abstract: The present study was performed in 2012-2014 crop years to determine the best planting season of Onobrychis visifoliya in Arsanjan, Fars. To this end, the factorial experiments were performed in the form of completely random blocks with three replications in both autumn and spring on a farm located in Arsanjan. The planting dates in the spring were 5th to 20th April and 5th to 20th May and the planting dates in the autumn were from 23rd August to 6th September and from 23rd September to 7th October. These dates in both seasons were selected as the main factors and three seeding rates of 80, 100, and 120 kg ha were considered as the secondary factors. Onobrychis visifoliya used in this study was a local ecotype of Fars Province. In addition, the measurement parameters were dry and wet matter yields and the protein contents of forages. The results indicated that the autumn planting season with a total yield of 18080 kg per hectare was significantly superior to the spring planting season with a total yield of 8800 kg per hectare in terms of foliage dry matter yield. Besides, the highest protein content of 21.75% was found in the autumn while the lowest protein content of 15.75% was found in the autumn due to an increase in the growing period, the energy intake, the increased carbohydrate, and the higher assimilates.

Keywords: Onobrychis visifoliya, spring planting, fall planting, protein content, foliage dry matter yield, foliage wet matter yield

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1. Introduction

Iran, with an average annual rainfall of 248 mm is one of the dry regions in the world. Basides, the water shortage problem in recent years has increased the need for more research on drought-resistant forage plants. The purpose of this study was to find out some mechanisms so that to provide a part of forage needed for the livestock with the minimum cost and to prevent water loss and soil erosion accordingly.

Onobrychis visifoliya has some favorable features such as high resistance against drought, cold tolerance, and alfalfa weevil, not causing

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bloat in animals, the possibly of storing it in silages because of its high ratio of carbohydrate to nitrogen, high nutritional value, the ability to grow in calcareous and alkaline soils, and its high salt tolerance. These features has made the areas under Onobrychis visifoliya cultivation be increased dramatically in Iran in recent years beside the introduction of new species such as Nova and Melrose from Canada, Eski, Remont, and Remunex from the United States, Zeus and Vala from Italy, Perly from Switzerland, Fakir from France, and Emyr from Hungary.

Mehrani (1993) reported that 30 cm spacing in seed planting has no significant effect on the qualitative and quantitative forage yield of Onobrychis visifoliya. Besides, the prolonged irrigation periods will reduce plant height and its regrowth rate.

In an experiment, Mohammadi (1975) observed that low row spacing and high planting density will increase the plant yield.

Mokhtar Zadeh Mohammadi (1998) compared 19 Onobrychis visifoliya planting ecotypes under normal circumstances for two consecutive crop years in different Iranian provinces in order to introduce the appropriate species. The results showed that the forage yield of ecotypes in Urmia Mimish Khan, Urmia (I), Janagh Bolaq in Ardabil, Oshnavieh, and Darband were categorized in Class A. In addition, the highest yield of 70.75 tons per hectare was reported for Urmia Mimish Khan ecotype.

Janab et al. (2001) performed a comparative study on 18 Onobrychis visifoliya ecotypes in Chahar Takhteh Station in the Agricultural Research Center of Chahar Mahal and Bakhtiari Province in terms of the yield. The highest forage wet matter yield of 68640 kg was reported for the Urmia (II) ecotype and the highest forage dry matter yield of 23710 kg was reported for the same ecotype.

Salehi (2005) studied the effects of planting date and seed rate on quantitative and qualitative characteristics of Onobrychis visifoliya in in the Agricultural Research Center of Chahar Mahal and Bakhtiari Province. The results indicated that planting date in September resulted in the highest forage wet matter yield. This was due to a temperature suitable for plant growth and its stability as well as the lower competition of weeds in the time period under study. In addition, it was found that a treatment amount of 100 kg seed per hectare produced about 40 tons of wet forage.

Shorper et al. (1992) in an experiment found that the lower plant density will result in the less competition among adjacent plants. Consequently, the higher amounts of photosynthesized materials will be generated for the seed production which in turn results in the improved harvest index.

Cash, Bowman, and Ditterline (1993), Kucheki (1976), Kucheki and Kahrobaian (1979) investigated the impact of irrigation periods of 10, 20, 30, and 40 days and no irrigation in different climatic conditions on Onobrychis visifoliya. Kucheki concluded that the yield reduction was only 20% from the 10 day period to 20 day period but it was over 40% from the 20 day period to 30 day period. As a result, the 20 day irrigation period was more cost effective than the 10 day period.

Walton, Koisito, and Lan (2011) recommended the seed consumption of about 20 to 40 kg per hectare.

2. Materials

The present study was performed in 2012-2014 crop years to determine the best planting season of Onobrychis visifoliya in Arsanjan, Fars. Mstatc Software was used to analysis the

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data. In addition, the mean scores were compared using the Duncan's test at 5% level of significance. The factorial experiments were performed in the form of completely random blocks with three replications in both autumn and spring on a farm located in Arsanjan. The planting dates in the spring were 5th to 20th April and 5th to 20th May and the planting dates in the autumn were from 23rd August to 6th September and from 23rd September to 7th October. These dates in both seasons were selected as the main factors and three seeding rates of 80, 100, and 120 kg ha were considered as the secondary factors. Onobrychis visifoliya used in this study was a local ecotype of Fars Province. The sampling and forage harvest at 50% flowering of Onobrychis visifoliya. Finally, the measurement parameters were dry and wet matter yields and the protein contents of forages

3. Results and Discussion

The results of the ANOVA (Table 1) suggested that the mutual effects of different planting dates, the density, and crop year on the wet forage yield of Onobrychis visifoliya in both spring and autumn plantings showed significant differences at significance level of 1%. Accordingly, the highest spring yield was related to the first planting date, the second density, and the second year with the rate of 36460 kg per hectare. In contrast, the lowest yield was related to the fourth planting date and the third density in the first year with the rate of 17920 kg per hectare. In addition, the highest autumn yield was found for the first planting date, the first density in the third year with the rate of 84530 kg per hectare while the lowest autumn yield was related to the second planting date and the second density in the first year with the rate of 42010 kg per hectare. A comparison of the two seasons indicated that the autumn planting season with a total yield of 18080 kg per hectare was significantly higher than the spring planting with a total yield of 8800 kg per hectare in terms of foliage dry matter yield.

Table 1: Comparison of wet forage yields of Onobrychis visifoliya in spring and autumn plantings (A: plating date; D: density, T: crop year)

Season	Planting date		A1	A2	A3	A4
	Year	Density				
Spring	D1	T1	24030h	23480hi	23680h	19260kl
		T2	36040a	35230ab	35520ab	28900f
	D2	T1	24310h	20260jk	21640ij	20390jk
		T2	36460a	30400ef	32460cd	30790de
	D3	T1	22760hi	19780jk	22500hi	17920l
		T2	34130bc	29670ef	33740bc	26880g
Fall	D1	T1	56360def	45890f	50790ef	55570def
		T2	84530a	68830bcd	76180abc	83350ab
	D2	T1	54170ef	42010f	50900ef	49140f
		T2	81250ab	76350abc	76350abc	73720abc
	D3	T1	49530f	49120f	45820f	43630f
		T2	74300abc	73680abc	68730bcd	65150cde

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In addition, the increased plant density and the seed rate in different planting dates in the autumn planting resulted in the reduced yield, indicating that the appropriate seeding rate for Onobrychis visifoliya in the autumn is 60 kg per ha. In general, the total wet forage yield in the second crop years was higher than the firs crop years since the depths of roots and the nitrogen fixation nodes had been increased during the second crop years. It was also noted that the increased plant density and seeding rate in the early spring planting dates resulted in increased yield but such increase in the timely and late planting dates reduced the yield. This seems to be due to poor germination in the early planting dates and the heavy shadings in the late planting dates.

Table 2: Comparison of dry forage yields of Onobrychis visifoliya in spring and autumn plantings (A: plating date; D: density, T: crop year)

Season	Planting date		A1	A2	A3	A4
	Year	Density				
Spring	D1	T1	7779f	7515fg	7814f	6357ij
		T2	11530a	11270ab	11720a	9536d
	D2	T1	7779f	6385ij	7170gh	6774hi
		T2	11670a	9727cd	10710b	10160c
	D3	T1	7282fgh	6330ij	7424fg	5914j
		T2	10920b	9494d	11140ab	8870e
Fall	D1	T1	16910defg	12850gh	14730gh	16110efg
		T2	25360a	19270cde	22090abc	24170ab
	D2	T1	16250efg	11760h	14760gh	14250gh
		T2	24380ab	21380abc	22140abc	21380abc
	D3	T1	14860fgh	13750gh	13290gh	12650gh
		T2	22290abc	20630bcd	19930cde	18890cdef

The results of the ANOVA in Table 2 suggested that the mutual effects of different planting dates, the density, and crop year on the dry forage yield of Onobrychis visifoliya in both spring and autumn plantings showed significant differences at significance level of 1%. As such, the highest spring yield was related to the third planting date and the first density in the second year with the rate of 11720 kg per hectare. On the other hand, the lowest yield was related to the fourth planting date and the third density in the first year with the rate of 5914 kg per hectare. In addition, the highest autumn yield was found for the first planting date, the first density in the second year with the rate of 25360 kg per hectare while the lowest autumn yield was related to the second planting date and the second density in the first year with the rate of 11760 kg per hectare. A comparison of the two seasons indicated that the autumn planting season with a total yield of 18080 kg per hectare was significantly higher than the spring planting with a total yield of 8800 kg per hectare in terms of foliage dry matter yield.

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Table 3: Protein content in spring and autumn (A: plating date; D: density)

Planting date		A1	A2	A3	A4	Mean
Season	Density					
Spring	D1	16.48ab	17.21ab	19.98a	17.94ab	17.90a
	D2	16.92ab	15.75b	19.83a	16.48ab	17.24a
	D3	18.08ab	17.35ab	18.08ab	17.94ab	17.86a
Fall	D1	17.94abc	17.15c	18.52abc	21.75a	18.34a
	D2	16.33bc	18.38abc	20.63ab	20.85ab	19.05a
	D3	16.63bc	19.40abc	17.54abc	20.63ab	18.55a

The results of the ANOVA as shown in Table 3 indicated that the mutual effects of different planting dates and the density on the protein content of Onobrychis visifoliya in both spring and autumn plantings showed significant differences at significance level of 1%. As such, the highest protein content in the spring was related to the third planting date and the first density, equivalent to 98.19%. On the other hand, the lowest protein content was related to the second planting date and the third density the rate of 75.15%. In addition, the highest autumn protein content was found for the fourth planting date and the first density with the rate of 75.21% while the lowest autumn protein content was related to the second planting date and the first density, equal to 17.15%. These findings indicate that the protein content was significantly higher in the autumn than in the spring which was due to an increase in the growing period, the energy intake, the increased carbohydrate, and the higher assimilates in the autumn planting.

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