Effect of seed distance, depth and sowing time on morphological traits of *Coronilla varia*

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Abstract

Lack of forage in semi-arid areas is one of the important issues in these areas. Cultivation of forages is effective terms to provide food of livestock in respect to rangeland condition and the high number of livestock. Obviously, it is necessary to identify cultivation circumstance and its approach based on plant physiological properties. We aimed to study the effects of time, depth, and sowing distance of *Coronilla varia* cultivation, seeds cultivated at three depth one, two and three cm and with distance of four, eight and twelve cm from each other at two level of times one and 15 march. The sextet growth characteristics investigated at 18 experiment unit during 15 weeks. The ANOVA based on Tukey's range test, results showed that cultivate treatments had significantly effect on the growth characteristics. The highest mean of stem height, length of leave, cross and height of branch and leave were recorded at sowing date of 15 March based on four cm distance and. Thereby, distance and sowing date has more effect related to depth. Distance of four cm and sowing date of 15 March provide better properties to growth for *Coronilla varia*.

Keywords: *Coronilla varia;* Plant physiological properties; growth characteristics; sowing time

Introduction

Rangelands have a critical role at environment sustainability including protection soil and prevent erosion, arrangement of water, livestock fodder, medical and industrial production, and save of vegan and animal genetic. Protection, reclamation, development and utilization of rangelands in addition to livestock fodder also is important, thereby play role for environmental. Increasing the growth of population and livestock production demand leads to rangeland degradation in terms of quality and quantity supply forage. In the recent years increasing some factors such as mining, deforestation and other unprincipled uses make national resources degradation (Zhu, 2001). Degradation of rangeland is important risk that included from climate, human intervention and technology is actuated decreasing of valuable species. So, development of forage sowing could be able to protect rangeland and increase production amount at reclamation methods like seeding and planting.

One of the important plant families is Leguminosae at forage product and soil protection included of *Coronilla varia*, *Medicago sp*. and *Trifolium sp*. Totally, Legums has critical role at fodder. It is used in husbandry due to full of protein and high quantity (Carlsson and Huss-Danell 2003). On the other hand, it can increase soil fertility by fixation of Nitrogen. In this case, Zamanian and Asadi, (2005) found that date of sowing, method and amount of seeds was effective for production of *Coronilla* sp. Real et al., (2011) was evaluated 174 Legums belong to 32 genius and 103 species in three years at 6 site in south of Australia. It showed that *Bituminaria bituminosa* var. *albomarginata*, *Cichorium australasicum*, *Dorycnium hirsutum*, *Kennedia prostrate*, *Lotononis bainesii*, *Lotus pedunculatus*, *L. cytisoides*, *Medicago sativa* subsp. *sativa*, *Medicago sativa* subsp. *Caerulea*, and *Medicago sativa* subsp. *Falcata*. had yield and proper adaptation. Real et al., (2011) evaluted 90 accessions of *Medicago sp*. based on their performance of premier variety in Michigan province of United State. Smreciu, (1995) studied proper Legums for mountainy area. Intercropping of *Astragalus alpinus* with *Oxytropis monticola* and *Oxytropis splendens* was expressed for reclamation of east slopes of Racy Mountain till 2000-m elevation. Noshkam et al., (2009) obtained significantly effect of density and sowing of date on quality and quantity of forage. They reported that performance of forage at 700 shrubs per square meter was strongly affected than 350 and 500 shrubs per square meter. Also, delay on the date caused to decreasing quantify and quantity of forage.

In order to control soil erosion, *Coronilla varia* was used for the first time in United State of America, then after that was used for another consuming following as: fodder as a high palatability that in respect of range of consuming cannot be cause bloating (Barnes and Dempsey, 1992). Different range of animals such as Gazelle, Deer, Rabbit and Rat used this plants as food and protection themselves (Burghart and Fiedler, 1996; Jones, 1990). The butterflies and worms used as host (Karowe, 1990). There are special function and valuable characteristics of this plant like avoiding of soil erosion, fixing edge of riparian (due to rhizomes), and improvement of soil physical and chemical structure through ecosystem function and nutrition cycling by nitrogen fixing, providing nectar for honey bees (Mandi, 2003).

This plant can persist hard environmental condition during dry season, heavy rainfall (up to 165mm/yr.) and low temperature (down of -33°C), but they cannot be tolerant of the waterlogged soil. The proper soil texture is Coarse-grained and Fine-grained (Sandy, Gravel, Loam, Silt and Clay) but not at small-grained soil. The soil fertility can be low and the pH must be 5-7.5 but not at salty and Solonchaks soil (Harper, 1996).

The depth of sowing and selection best species is one of critical key to influence of successfully of seedling. This parameter has main effects to generation, growth and Seedling establishment. So, there are some reason of non-ability of growing the seedling due to planting at insufficient of moisture and high depth (Mahdi et al., 1998). In order to planting this species in desert area we need to attention about the suitable number of seeds at right date and depth. Toledo et al., (2011) showed that seedling establishment had been affected by depth, size of seed, variety and soil texture so that the growth be reduce linearity by depth increasing from 2 to 20 cm. Khosravi and Rahimian, (2005) found that changing depth of *Bunium persicum* from 5 to 10 cm led to increasing height and number of primary branch and increasing more than 12.5cm led to significantly reducing at different traits yield. Since the success restoration of rangeland projects is related to climatic factors, therefore should study species yield at different climatic situation to discover best achievement. Additionally, the protection and reproduction of rangeland vegetation is a key important issue due to avoid of land degradation. One of the main limitations of arid area is lacking of surface of soil moisture (Jafari, 2009).

The purpose of this study is argues to the best depth to have successful seedling planning. Species density per square meter will guide us to reduce inter-specific competition and choosing best planting density. In order to optimal seedling with maximum production efficiency, it is needed to understand about knowledge of different features of ecosystem that prepare for growing vegetation (date, distance sowing, suitable circumstance of generation, etc.). For this purpose, we aim to study of ecological investigation of one of important rangeland species (Botanical, nutrition role for feeding livestock).

Materials and Methods

Study area

The study area is located at research station in Gorgan university of Agricultural Sciences and Natural Resources on 54° 16" longitudes 36° 51" latitude, at the 120m of Sea level. The mean 15 annual precipitation is 650 mm and minimum annual temperature is -2.4° C and maximum is +40°C. From March 1 to March 15, the minimum temperature is 2 ° C and the maximum temperature is 15 ° C.

Preparing the seed and planting surface

The amount of *Coronilla varia* seeds was provided with 80% germination percentages from Organization of Jehad-e-Keshavarzi. In order to stratification on seed dormancy, seeds were placed on petri dishes containing filter paper saturated with distilled water at two days, then took out and dry them. We aimed to study the effects of time, depth, and sowing distance of *Coronilla varia* cultivation on some growth parameters such as stem height, leaf length, Leaf width, width and height of foliage at two different the date of sowing. To removing effects of adjacent shrubs, we used circle plots. As seeds were planted at three depths: one, two and three cm with four, 8 and 12 cm distance at two dates first and 15th of March, and two raw with 25cm intervals (figure 1). Each treatments composition was placed in three replications (18 plots).

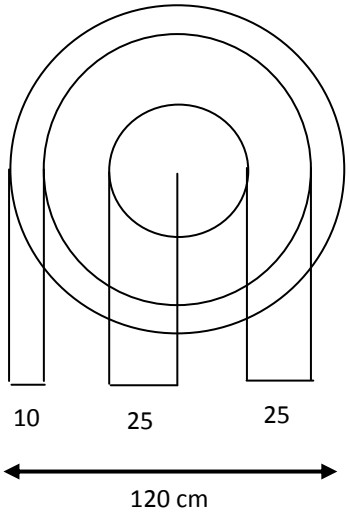

Fig. 1 Information of size and form of using plots

Treatments characteristics

According to the table 1, there were about 18 treatments. The treatments were composed of three factors including seeding depth (three depth of 1, 2 and 3 cm), seeding distance (three distance of 4, 8 and 12) (density) and seeding date (two date of 1th and 15th of March).

Data Analysis

Totally, 18 treatments were determined and six growth parameters were measured in one growing periods around four months. The means of analysis of variance analysis (ANOVA, One- way) was used to determine the effects of six treatments in Mini-Tab software version.

Table 1 show each of properties which was studied.

Date (March)	**Depth**	**Distance**	**Test Units (treatments)**	**Date** (March)	**Depth**	**Distance**	**Test Unit (treatments)**
15th	2	4	10	1st	3	4	1
1st	1	4	11	1st	2	8	2
1st	3	8	12	15th	3	4	3
15th	3	8	13	1st	2	8	4
15th	1	4	14	1st	2	12	5
15th	1	12	15	15th	2	12	6
1st	1	8	16	15th	3	12	7
1st	1	12	17	15th	2	4	8
15th	1	8	18	1st	3	12	9

Results

ANOVA indicated that height of stem parameter interacted (P= 0.000, F=22.58). The statistically significant differences between means were tested and results showed that treatment three devoted highest mean and 9,15,16,17 had lowest value (Figure 2). ANOVA for leaf length was statistically different (P= 0.000, F=12.53). The highest mean value were for three, 6 and 14, and the lowest mean value were for 9, 16, 17 respectively (Figure 3). The ANOVA for leaf weight was statistically different (P= 0.000, F=38.71). The highest mean value were for 8,5 and 13, and the lowest mean value were for 9, 16, 17 respectively (Figure 4). The statistically difference was proved between treatment and length of branch (P= 0.000, F=18.68). The results showed that number 14 of treatments had highest mean and 9, 16 and 17 had lowest mean value (Figure 5). The ANOVA was demonstrated statistically difference between treatment and width of branch (P= 0.000, F= 21.23). The results showed that 3 and 5 of treatments had highest mean and 9, 16 and 17 had lowest mean value (Figure 6). The latest analysis was height of branch that showed significantly difference (P= 0.000, F= 22.09). The results showed that 3 of treatments had highest mean and 9, 16 and 17 had lowest mean value (Figure 7).

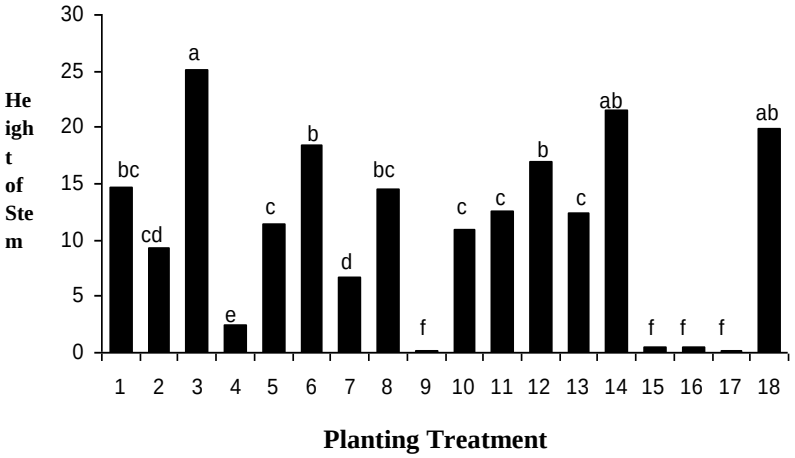

Fig. 2 Mean comparison for different treatments on stem Height

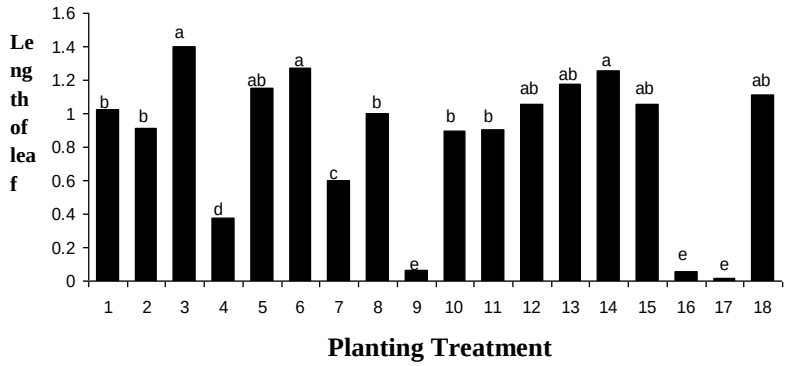

Fig. 3 Mean comparison for different treatments on leaf length

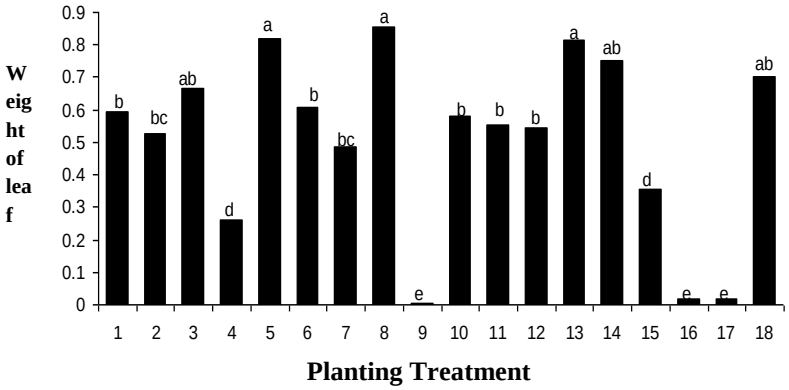

Fig. 4 Mean comparison for different treatments on leaf weight

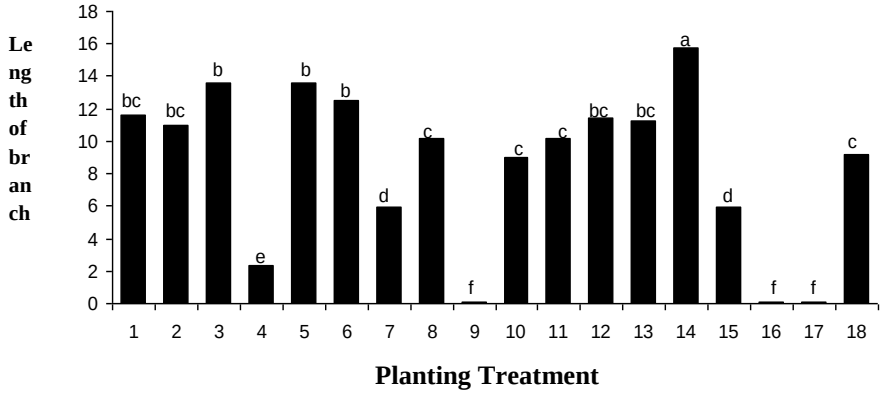

Fig. 5 Mean comparison for different treatments on Length of branch

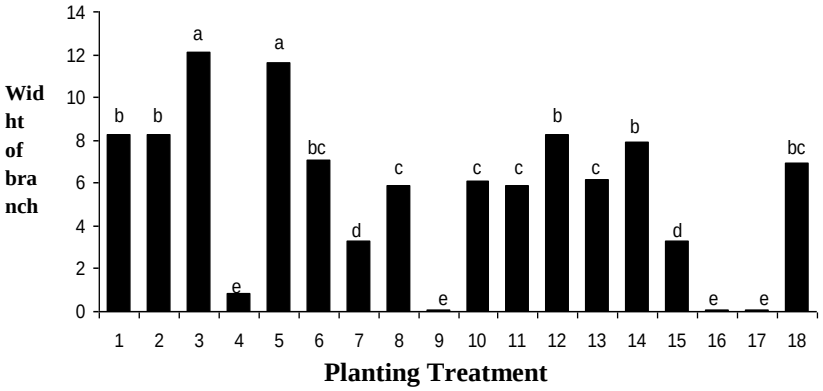

Fig. 6 Mean comparison for different treatments on width of branch

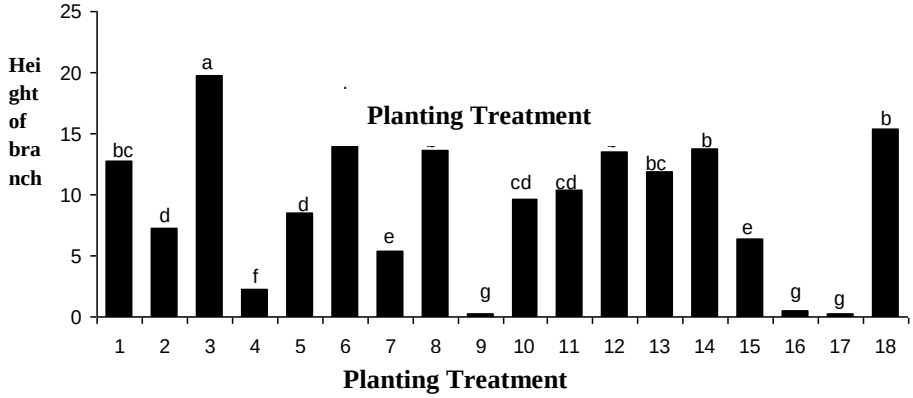

Fig. 7 Mean comparison for different treatments on height of branch

Discussion

One of reclamation methods is seedlings in rangelands led to unsatisfactory projects due to soil erosion, non-proper soil depth, soil moisture variation and feeding by birds and other animals. These caused local plants have low germination or after germination could not be able to establish. Therefore, for this reasons, should consider factors such as distance, density of planting and depth (Kephart and Wichman, 2004). Selection of these parameters leads to save-cost, increasing plant yield and facilitate the potential rehabilitation of forests (Mosaddeq, 1981). The results showed that there were clear differences between planting treatments and growth parameters and it coincidented with other researches (Zamanian and Asadi, 2005; Noshkam et al., 2009).

Toledo et al., (2011) found that establishment of grasses seedling depended on depth of sowing, seed size, variety and soil texture. So that, establishing decreased linear by increasing the depth from 2 to 20 cm. Khosravi and Rahimian (2005), reported that change depth of sowing from 5 to 10 cm produced increasing height and number of primarily branches of *Bunium persicum* but increasing depth to up 12.5cm lead to strongly declined at other characteristics yield. Bagheri (2014), showed that changing at depth of sowing had been affected on germination and flowering of *Agropyron desertorum*. The traits of this species had significantly difference by increasing the depth of sowing at 3 and 4.5 cm and controlling treatments at 0.5cm. Maximum and minimum speed of germination was achieved at 0.5 and 4.5cm depth of sowing. The seeds sowed at 4.5cm of depth have minimum germination percent related to 0.5 cm. They suggested 1.5 cm depth of sowing is suitable.

Through straight of growing traits, just treatments 9, 16 and 17 has minimum mean. It proposed increasing of distance has negative effect on growing traits. Treatments three has maximum mean among others. Treatment 8

has maximum mean of width of leaf and 14 has highest mean for length of branch. Every three treatments that had highest mean showed that densely sowing of *Coronilla varia* led to better growing with four cm distance of sowing. McCreay, (1989) recommended that *Quercus lobota* and *Q. douglasii* species delaying on date (October against August) had significantly effect on germination declining. Tabari and Ghelichkhani, (2007) studied depth (8, 3 and 13) and date of sowing (5^{th} January and 5^{th} March) on the germination of *Qercus sp.* the results showed that low depth (3cm) and medium (8cm) was suitable items at seedlings project. Moreover, seed planted at 1^{st} of March related to frist week of January showed highest germination percent.

To achieve the effects Inter-cropping and monoculture of legumes and grasses on forage yield were conducted in Saral Agricultural research institute in Kordestan province. Experimental treatments were arranged as factorial rain fed condition with three replications (Hosseini, 2013). He was found that effect of planting condition on forage yield was exclusively significant at fourth and fifth years. *Medicago sp.* With 2706 and 2199 kg/ha dry matter was higher priority more than other treatments. The results of these experiments was determined the use of monoculture and interaction between density and culture type prevails over the second year on forage yield. The highest yield was determined at high plant density with 1049 kg/ha. The analysed of complex data indicated the monoculture of *Medicago sp.* highest production with average 1744 kg/ha of treatment compared to other cultures type and was highest forage yield in the fourth year (1769kg/ha). Germination percentage of *Astragalus adscendens* and plants growing were strongly influenced by analysis of the seed depth planting and drought treatment in at Brojerd city (Rezaii et al., 2012).

Overall, densely sowing can be used to make positive effective related to date on forage production of Leguminosae family. It be concluded that depth of sowing depended to different factors; seed size, soil type and climate (Azarnivand and Zare, 2008). Sowing at fewer depth as well as seed becomes tiny. Also, seeds must plant at deeper depth in light soil (sometimes more than3cm) (Blinda et al., 1997). As respect to soil texture, depth of sowing should consider 2 to 5 times more than large diameter of seeds. The depth of sowing at soils with light texture, observed more than heavy soil (Azarnivand and Zare Chahoki, 2008). Furthermore, the depth of sowing must be higher at arid regions than humid areas (Naseri Mahalati et al., 2005). Rahimizadeh et al., (2009) exhibited suitable sowing density at forage and seed production for *M.polymorpha, M.truncatula, M.scutellata* and *M.rugosa* at two different conditions (greenhouse and farmland). At the first test, the optimum plant density was maintained at 800 per $1m^2$ for forage production of these species and *M.scutellata* specie had more forage production; however, pericarp function was increased by optimal plant density 100 plants. On average, soil moisture, depth of planting and seed coating type interaction to obtain highest significant germination were required to sow at 9, 14 and 21 percent of soil moisture, with 1cm soil depth (Mehrabi, 2010), however, observation of interaction effects of treatments was not response to dry matter. Increasing of moisture and depth was significantly increasing effect on dry matter.

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