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Assessment of Seed Bed Preparation Methods on Seedling Emergence Rate in Range Species (Case study: Kashan Rangelands of Iran)

Sajad Hosseinzadeh Monfared
Young Researchers and Elite Club,
Karaj Branch, Islamic Azad University, Karaj, IRAN

(Corresponding author: Sajad Hosseinzadeh Monfared)
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ABSTRACT: This study was conducted to compare the methods of seed bed preparation in rangelands of Kashan region in Esfahan province in Iran. A split plot design was conducted based on Randomized complete block design with three replications in 2011. Five seed bed preparation methods were used as main plot as: 1) Seed sown by passing livestock. 2) Seed sown machinery. 3) Seeds sown as drilled into furrows. 4) Seeds sowing into furrows covered by straw mulch .5) Seed sown machinery and pressed by roller. Six range species were used as: *Artemisia santolina, Eurotia ceratoides, Kochia lanta, Salsola rigida, Salvia sp.* and *Artemisia sieberi,* as sub-plot. The results of experiment showed significant differences among the seed bed preparation methods on seedling emergence rate. *Salsola* and *Eurotia* had higher germination percent when they sown and passing through livestock. *Kochia* and *Eurotia* had higher germination by machinery seeder followed by roller. The lowest germination percent was obtained by method of seed sowing in furrows covered by straw mulch and seeds were sown machinery. Among the species, *Eurotia, Kochia* and *Salsola* were ranked in the first order followed by Artemisia. The *Salvia* species. Had no germination for all of seed bed treatments.

Key words: Seed bed preparation, Range establishment, Rangeland, Kashan, Range species.

INTRODUCTION

Reform and revive pastures increased quality and quantity of forage production and livestock roducts to bring the maximum possible. The main goal of reform project and revive pastures is the access to special plant community that has good palatability for livestock, the retainment of water in the soil which prevents it from wind erosion. One of the major issues in Kashan rangelands (In the same province) is lack of pasture species with high quality and palatability and existence of undesirable and non-palatability species in plant community composition of rangelands. To overcome these problems, cultivation of compatible species led to increased pasture quality and creating favorable conditions for the species through appropriate management of rangelands, as well as the undesirable species can be controlled. Fundamental issue in this regard is seed bed preparation and sowing of compactable species in the rangelands. Without making seed bed preparation, the cost of seeding operations will be increased and much of plant will be died and sprouts planted will not be in a good growth. Peymani and Tarifi (1984) found that cultivation of legume family (Fabaceae) and other broadleaf forage plants in the spring in both regions of Hamand Absard and Novdehak Qazvin (half-steppe and steppe zones) were better than the autumn planting. The reason was that broadleaf plants in these areas were more sensitive to cold than grasses and the seedling were much sensitive to winter cold in their early growth and development stages. Planting depth is also one of the important factors in pasture improvement. Their study showed that the seed sowing in depth of 5 to 10 cm would be desired result. One of the most important problems in such semi-arid and arid areas is water shortage and fast drying of soil surface, due to dry air and high evaporation rates. So we can conclude that most of the seeds that cultivated within the 10 cm depth furrow had more favorable results compared to those cultivated in the 5 cm depth furrows. Sayadi in his study (1984) in the region of semi-steppe in Firoozkooh, Tehran, cultivated some pasture plants as pure stand and mixed cropping. His results showed that pure stand of *Agropyron intermedium*, *Agropyron desertrum*, and mix-cropping, of *Onobrichis sativa* + *Poterium sanguisorba* and *Poterium sanguisorba* + *Agropyron desertrum* had higher production than natural pastures in that region. Arefian (1997) in a study showed that machinery planting method including plowing + disk + roller couple with seed rate 15 kg.ha^{-1} for grass and 20 kg ha^{-1} for other species were much appropriate.

Oled Belqasem *et al.* (2005) examined the effect of seed age and planting depth on seedling growth of *Stipa lagascae.* Some characteristics as seed germination percent, seedling vigor and seedling biomass for both young and old seeds were measured. Their results showed that seed age had no effect on seedling characteristics. However seed depth had significant effects on seed germination. The best seed depth was obtained as 6-4 cm.

Snyman (2003) studied different methods of lands restoration in semi-arid rangelands of South Africa. He used different plant species and different seed bed preparation method for both clay and sandy soil. His results showed that deep plowing of the soil will kept more water for the grass establishment and more plants were survived than conventional tillage. In conventional tillage method, the amount stored water in the soil was low. Despite the well established species *Eragrostis curvula* in the first three years, after 10 years, a few plants in both clay and sandy soil were survived. Regardless of the planting method and soil type, species *Digitaria eriantha, eriantha* subspecies were more survival in 10 years old pasture. These species even were distributed to other places. *Anthephora pubescense* and *Cenchrus ciliaris* were successfully deployed only in sandy soil. The objective of present research was to compare methods of seed bed preparation in order to determine best practices that positively influence the establishment of seeds of *Artemisia santolina, Eurotia ceratoides, Kochia lanta, Astragalus squarrosus, Salvia* sp. and *Artemisia sieberi*.

MATERIAL AND METHODS

Experiment was carried out in the Kashan Station rangeland management from 2011 to 2013. The area was in the 30 km northwest of Kashan city, annual precipitation was 192 mm, and annual average temperature was 25.16°C, Soil texture was sandy.

A split plot design using randomized complete block with three replications was used. Main factors include treatments in different methods of seed bed preparing in 5 levels as follows:

1. Seed sowing and passed by intensive animal (sheep) crossing for making seeds buried in soil.
2. Plowing and machinery seed sowing.
3. Make furrow in depth of 10 cm and sowing seeds in furrows.
4. Make furrow and sowing seeds within furrow and covered by straw mulch.
5. Plowing and machinery seed sowing followed by pressing by rollers

Sub-factors were 6 range species as follows:

1. *Artemisia santolina*
2. *Erotia ceratoides*
3. *Kochia lanta*
4. *Salsola rigida*
5. *Salvia* sp.
6. *Artemisia sieberi*

Areas were kept from animals grazing. Plot's area was $10 \times 10 = 100m^2$. Total of experimental units were 3 replications × 6 methods × 6 species = 90. Thus, the land area for the project was 9000 m^2.

Planting was done in the December 2011. Planting depth was according to the type of seed bed preparation and planting methods in the range of 5 to 10 cm. Data were recorded for percentage of seedling emergence and establishment, during growing season in spring and summer. Statistical analysis of comparison test was performed using SAS statistical software and graphing was performed with Excel software.

RESULTS AND DISCUSSION

The analysis of variance showed significant differences among seed bed preparation methods for seedling emergence of species (Table 1).

Table 1: Analysis of Variance Test Treatments.

S.O.V	DF	SS	MS	F value
Block (B)	2	32.00	16.00	246.15 ^{ns}
Seed bed preparation (a)	4	7868.40	1967.10	30263.1**
Error1	8	3.40	0.425	6.54
Species (b)	4	7236.30	1809.07	27831.9 **
Error2	16	26965.80	1685.36	25828.7

** = Significant Difference among Treatments at 1%, ^{ns} = No Significant Difference.

A. Seed sowing and animal crossing

In this Method *Eurotia ceratoides* seedling emergence was very favorable (80%). The plants were survived up to three years, but due to drought conditions in subsequent years, they were vanished.

Astragalus squarrosus species with 40 percent emergence was the next category. For this method, the rate of seedling emergence were small and non-significant of other species (Fig. 1).

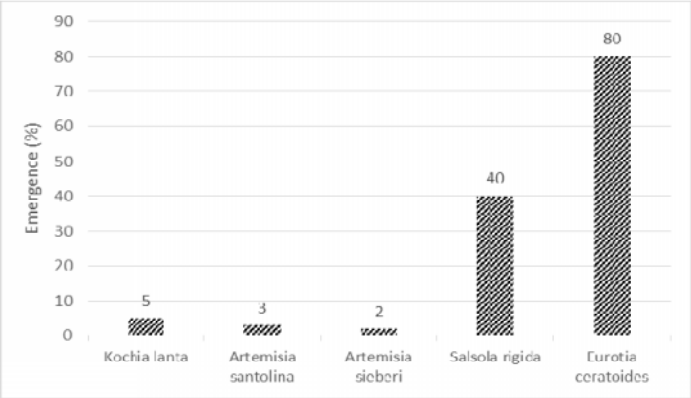

Fig. 1. Percentage of Seedling Emergence in 5 Range Species Using Seeding and Intensive Livestock Crossing Treatment.

B. Machinery sowing using seeder

Almost none in the cultivated species were established for this sowing method. The *Salsola rigida* and *Eurotia ceratoides* had 2 and 1 percent seedling emergence rate, respectively (Fig. 2).

C. Plowing, sowing and followed by roller

In this method the *Kochia lanta* species had 95% seedling emergence rate. This result was very good compared to other species. The *Eurotia ceratoides* species with 20 percent emergence was in the second rank. Emergence of other species was low and non significant (Fig. 3).

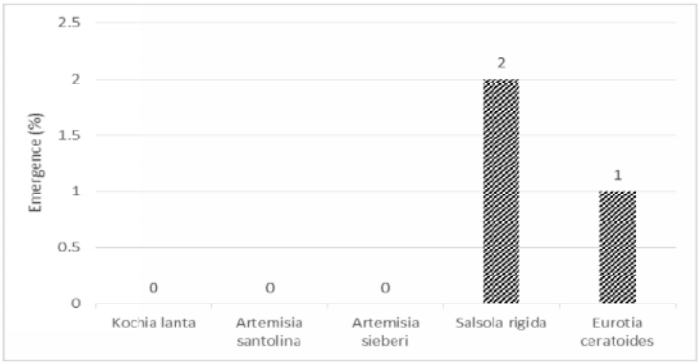

Fig. 2. Percentage of Seedling Emergence in 5 Range Species Using Conventional Seeding Treatment.

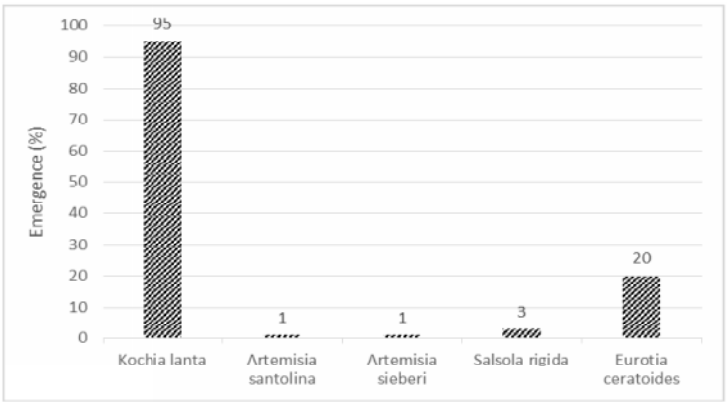

Fig. 3. Percentage Seedling Emergence in 5 Range Species Using the Plow, Disk and Roller Treatment.

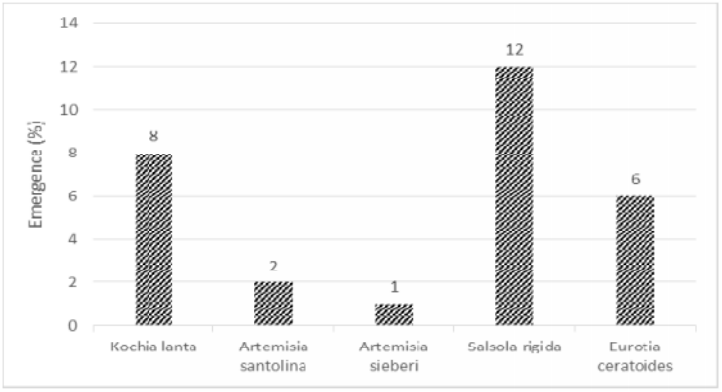

Fig. 4. Percentage Emergence of Seedling Emergence in 5 Range Species Using Furrow and Seeding Treatment.

D. Seed sowing in the 10 cm depth furrows

In this method, seedling emergence rate for *Salsola rigida* with average values of 12% was higher than others. *Kochia lanta* and *Eurotia ceratoides* with average values 8% and 6% were ranked as the second groups respectively (Fig. 4).

E. Seed sowing in furrow and covered by straw mulching

In such treatment *Salsola rigida* with average values of 14% seedling emergence, was better than other species. *Kochia lanta* and *Eurotia ceratoides* with average values of 10.5% and 8.5% of seedling emergence rate respectively were ranked in the following categories. Seedling emergence of other species was low and non-significant (Fig. 5).

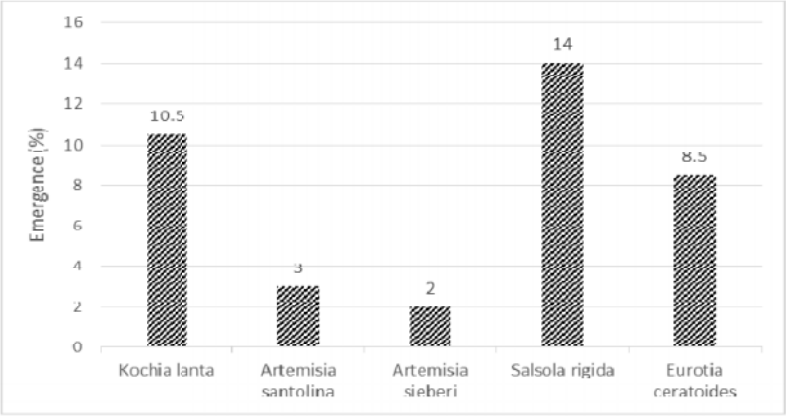

Fig. 5. Percentage Seedling Emergence of 5 Range Species Using Seeding Furrow and Use of Straw Mulch.

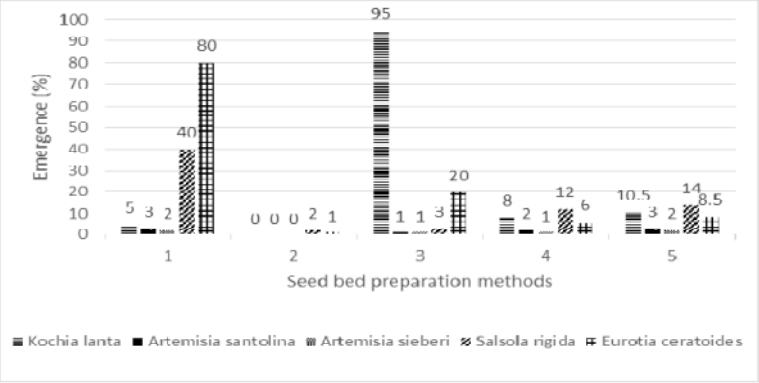

Fig. 6. The Interaction between Different Treatments of Seed Bed Preparation and Species for Seedling Emergence Rate.

For all of planting methods, the species of *Salvia* sp. did not emerge in any of treatments, which may be due to high water needed for germination and seedling emergence. The interaction effects among species and seed bed treatments were shown in (Fig. 6). The results showed that *Kochia lanta*, *Eurotia ceratoides* and *Salsola rigida* had better establishment than other species. It appears that the amount of moisture needed to stimulate seed germination and emergence in most species of *Artemisia* and *Stipa* genera was more than *Kochia* and *Salsola* species. Because the rate of seedling emergence in all treatments for Artemisia species was low and for *Stipa* was zero. Comparison among the main effects of seed bed preparation methods, using DMRT method, are shown in Table 3. Spraying and passing intensive livestock were the best methods, and plowing, disc and rollers were in the next step. The average rate of emergence of different species in these methods, was 26 and 24 percent respectively (Table 3).

Table 2: The Rainfall Requirement for Species Used in the Experiment (Peymani *et al.*1994).

Plant species	Annual rainfall needed (mm)
Artemisis santolina	150-200
Eurotia ceratoides	200
Kochia lanta	100-150
Salsola rigida	100
Salvia sp	150-200

Table 3: Comparison among 5 Method of Seed bed Preparation.

Treatments	Seedling emergence(%)	Duncan Group*
1-Seeding and intensive livestock cross	26.0	A
2-Seeding with regular seeder	24.0	B
3 -Plowing and disc and rollers	7.6	C
4 -Creating furrow and seeding	5.8	D
5 -Furrow seeding and using straw mulch	0.6	E

* Treatments Followed by the Different Letters Indicate Significant Differences Based on DMRT Method.

Table 4: Comparison among 5 Species of Experiment.

Plant species	Seedling emergence(%)	Duncan Group*
Kochia lanta	23.7	A
Eurtotia ceratoides	23.1	A
Salsola rigida	14.2	B
Artemisia santolina	1.8	C
Artemisia sieberi	1.2	C

* Treatments Followed by the Different Letters Indicate Significant Differences Based on DMRT Method.

Comparison among the main effects of seed bed preparation methods on species average seedling emergence, using DMRT method, are shown in Table 4. According to the results of the experiment, the species *Kochia lanta* with average values of 23.7% seedling emergence at planting bed preparation treatments, despite drought conditions, dominated the region had the highest emergence value (Table 4).

The observation of area showed that the region had a high distribution of *Kochia lanta*. This indicates that adaptation and regeneration of *Kochia* by seed to these conditions is high and regeneration of rangelands through seeding to cover rangelands for the revival and protection of soil is possible. *Eurotia* species, with the little difference is followed by *Zygophyllum*.

In sowing treatment followed by animal crossing, *Eurotia ceratoides* with average values of 80% had highest seedling emergence (Fig. 1). This species has high palatability and it is subjected to over-grazing pressure by livestock in the Kashan pastures, so, the grazing management for recovery of this species in the region could be effective.

Since the plant establishment in sowing treatment followed by animal passing has low cost less than other methods. Therefore, providing appropriate seeds and its use in the reclamation area ranges can increase the percentage of palatable plant in the pastures.

Salsola species with 14.2% average seedling emergence was located in next category after *Kochia* and *Eurotia* (table 4). At the sowing and pass through intensive livestock, the seedling emergence showed was relatively high (40%) than other species. it is explained by the morphological characteristics of the Salsola by having deep roots and its role in protecting the soil and restore rangeland degradation (Fig. 1).

Artemisia species used in the experiment, despite a large expansion in the Kashan area, it had lower values for all treatments, this is probably due to higher water requirement of these species so that in drought years have failed appropriate growth (Table 2), or the methods used in this experiment according regeneration by seed was not suitable to provide enough establishment than other planting methods, especially in terms of planting depth on this species to be tested. Among the seed bed preparation treatments, the seed sowing and cross by livestock with average 26%, had highest seedling emergence rate than other treatments (Table 3). This method had low cost for recovery and reform in rangeland through seed sowing. The method is also particularly more suitable for *Astragalus* and *Eurotia* than the two species in this treatment (Fig. 1).

Tillage, disk and rollers method was in the next rank in terms of percentage of seedling emergence. In this way, the use of appropriate rollers causes soil compaction, and contact between seeds and soil, so seed can use more desirable moisture stored in the soil. This method, especially for seed germination and emergence was very effective for Kochia and Eurotia than of the other species (Fig. 3), although this method due to its higher cost is not advisable.

Furrow and seed sowing and coverage by straw mulch had higher effect on Astragalus, Eurotia and Kochia than other species (Fig. 5). According to the positive effects of straw mulch in planting beds retain moisture seed, the beneficial effects were noted. It should be noted that the results obtained in drought years and if these tests were done in normal or wet years, the seedling emergence would be improved.

In most experiments for seed sowing of range species in areas with more than 350 mm annual rainfall has been successful. However for areas with rainfall less than 350 mm resistant strains were needed. In small-scale efforts undertaken, but in wide- scale pasture it has not been associated with great success.

Peymani and Tarify (1984) in their five-years experiment in two places included Hamand Absard and Novdehak Qazvin on 17 species of native range species, concluded that grasses were much resistance to cold, So, fall sowing had a better result, but for forage legumes and other broadleaf plants they suggested spring sowing in both regions. Since, broad-leaved plants are more sensitive to cold and can not tolerate cold in the early growth of winter. Experiment conducted in Kashan area, showed that rainfall in the season often occurs in autumn and winter, so, autumn planting are suggested. But, according to the drought conditions, autumn sowing did not desired results. Arefyan (1997) studied appropriate levels of seeds sowing pasture management. He concluded that the tillage plus roller method coupled with 15 kg.ha-1seeds for grass and 20 kg.ha-1 seeds for alfalfa were more appropriate than other treatments. In present study, the use of rollers had positive effect in germination rate, especially for species *Eurotia* and *Zygophyllum*.

Abu-irmayleh (1994) in his study concluded that the lack of soil moisture and high temperatures cause to reduce the plant growth. In our study in the Kashan area with low rainfall and lack of sufficient moisture in seed bed area and the seedling emergence were weak. Depth of seed sowing experiments conducted in the region according to Kashan seed bed preparation and sowing treatments, was 5 to 10 cm. Ouled Belgasem *et al.* (2000) in their experiments concluded that the planting depth of 6- 4 cm is best for the species Stipa.

This research project was set to compare methods of seed bed preparation in Kashan region in the conditions of a long period of drought and the dominant annual rainfall was less than average. Therefore, the low establishment of species could not probably obtain for normal or wet years. So, it is suggested to test the same experiment for two consecutive years in condition with normal rainfall to get appropriate conclusion for similar climatic conditions.

REFERENCES

Abu- irmaileh BE. (1994). Problems in re vegetation from seed of rangelands on calcareous clay soils in Jordan. *Journal of Arid Environments.* Volume **27**, Issue 4, Pages 375-385.

Anonymous. (2003). Weather statistics Kashan synoptic stations. Iran Meteorological Organization.

Arefyan R. (1997). Review and determine the most appropriate seeding rates, and best managed pasture plant species. Research Center of Natural Resources and Animal Affairs of Golestan province.

Fayaz M. (2000). Kashan vegetation zone. *Research Institute of Forests and Range Publications*. Publication No. 245.

Fazilati A, Hosseini Iraqis H. (1985). Rangeland management practices and reform the country and restore it. Joint Technical Committee Publications Office of Forests and Rangelands Organization pasture and agricultural promotion organization.

Kardavany P. (1992). Rangelands, problems and solutions in Iran. Tehran University Press.

Mesdaghi M. (1985). Instructions cultivated pasture and forage crops under rain fed conditions. Post Magazine of Natural Resources, *Department of Natural Resources of Gorgan, No. 9.*

Mesdaghi M. (1995). Rangeland management in Iran. University Press of Imam Reza.

Ouled Belgasem Am, Neffsti VP, Chaieb M. (2005). Effects of seed age and seeding depth on growth of Stipa lagascaseedlings. *Journal of Arid Environments.*

Peymani fard B, Malek-Pour Me, Faezi Poor B. (1994). Introduce important plants cultivated pasture and guide them to different regions. *Research Institute of Forests and Range Publications. Publication No. 24.*

Peymani B, Trify A. (1984). Rangeland reform by exploring the growing season, depth, method and amount of cultivated plant seeds to drought-resistant pasture. *Research Institute of Forests and Range Publications.*

Sayyadi M. (1984). Increase production capacity ranges from choosing the appropriate forage species and the impact of planting method. *Research Institute of Forests and Range Publications. Publication No. 11*.

Snyman HA. (2003). Revegetation of bare patches in a semi-arid rangeland of South Africa: An evaluation of various techniques. *Journal of Arid Environments*, Vol. **55**, Issue 3, pages 417-432.