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# Effect of subsoiler ripper in increase of range production in central of Iran (case study: Kashan plain)

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**ABSTRACT**

*In order to find a solution for the problems created due to the negative effects of severe conditions of the ecosystem of desert surrounding pistachio fields and other agricultural activities in salt flat of Kashan, the present research was carried out with the aim of increasing pastures and balancing the mentioned ecosystem by determining the most adequate pasture species and the method of planting. In this research, two plant species Suaeda fruticosa and Atriplex canisence were planted using split-plot in pot planting method with and without reaping operation (breaking the hard pan) in a split-plot statistical design and with random blocking design. Planting was done in dry farming way in March. It was watered 3 times in the first years. The statistical data were analyzed each year and variance was obtained. Finally, the most adequate planting method and species were determined using the results and data analysis.*

**Keywords:** Desert reclamation, Survival, Hard layer, Reaping, Salt flat of Kashan.

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## INTRODUCTION

Nowadays, tiller techniques are obtained by minimizing environmental damages with performing tiller operation to provide optimum conditions for the growth of production. This provides appropriate conditions for penetration precipitation and root expansion in addition to increasing ventilation, porosity and soil permeation [3, 4]. If the tiller operation is not performed at appropriate time and with appropriate instrument, it will not save precipitation in soil and will also create water way and finally will bring out soil erosion [6]. In irrigation farming and farming on humid region, soil fertility is a determining factor but in dry farming, rain and the amount of humidity are main factors and should be increased by applying correct method, the maintenance and the soil humidity should be saved and increased so that plant could absorb its required water [8]. Although success in dry farming is mostly dependent on precipitation, correct method of tiller and planting have a major effect on better farming and consequently production increase [2]. Recognizing and determining capacity and elements of native plants as well as the connection among these resources in the desert under investigation are necessary [2]. It obvious that by knowing the relation between biological elements and their origin, basic standards will be obtained to evaluate ecological power of production and to avoid misjudgment and wrong planning [5]. Alavipanah [1] investigated the effect of calcium carbonate and lime dolls on the performance of *Atripex lentiphormis* along Abarkooh desert and concluded that calcium carbonate is effective on the performance of some plants by creating characteristics such as hard pan lime dolls and particle-size distribution in soil. Heidari Sultanabadi and Mizanzade (2005) studied impact of tillage on some physical features of soil and sunflower performance in Mahyar plains in Esfahan [7]. In this research, first soil

tillage by sub-soilor to the depth of 45-50 cm and then was returned to the depth of 25 cm by plough. The researchers concluded that the resistance of soil against permeation in tillage plough with depth of 40-45 cm was less than plough without tillage [7]. The main purpose of the present research was to determine the most appropriate aridity and salty pasture in terms of survivor, the amounts of fodder production and determining the most appropriate planting method for desirable exploitation of 5000 hectare from salty and desert in lands of Kesht and Sanat-e-Isare Fajr of Kashan company. The other purpose of the research was to adjust desert ecosystem surrounding and farms and pistachio gardens of the mentioned company and to generalized the obtained result of the study to revival of hundred thousand hectares of desert plain around the location of the research project and to use the wide existing potential (water, soil and solar energy). The results of this research will hopefully provide sufficient knowledge to settle the appropriate plant with the aim of balancing the hard and fragile desert ecosystem surrounding the gardens and fields.

## MATERIALS AND METHODS

Research location is situated in 5000 hectare lands of Kesht-va-Sanat Isare Fajr and 60 km away from western north of Kashan. The altitude from sea level is 900 m and except sandy hills with limited area no other problem is observed. Lands units are seen as torrential and flat plain with fine texture. It is noteworthy seasonal waterway and distributed gravel hills are among geomorphological side effects of the region. The level of subterranean water table is 4m from the ground surface. The important features of the soil in the aerial under investigation are following: flat lands with slope less than 2% with superfine sediments, subterranean water surface near the ground surface or at little depth from the soil surface, having signs of salt collection and in some areas sand collection. Generally loom siliceous textures are with salty limitation (A3) and very salty (A4) and alkali (A3) and very alkali (A4) besides at the 40 cm depth (hard pan) is observed. In Table 1, the laboratory results of major parameters relevant to soil profile digger in the area are summarized.

**Table 1. Analysis result of soil around the location of the research projectable**

| Chalk 100 g | Carbon 6% | K (ppm) | P (ppm) | SP | SAR | E. Na Me/155 | EC | pH | Depth (cm) |
|---|---|---|---|---|---|---|---|---|---|
| 26.93 | 0.12 | 75 | 26.9 | 27 | 11.139 | 1.467 | 27 | 8.05 | 40 |
| 17.36 | 0.032 | 51 | 1.20 | 31 | 126.27 | 7.345 | 70 | 7.88 | 80 |
| 14.46 | 0.034 | 41.5 | 1.60 | 25 | 80.29 | 5.694 | 60 | 8.09 | 120 |
| 4.46 | 0.040 | 33.5 | 1.60 | 27 | 30.01 | 3.175 | 31.5 | 7.96 | 160 |

In this research, two plant species, Suaeda fruticosa and Atriplex canisence, were planted using sapling pot planting method with and without reaping operation (breaking the hard pan) in a split-plot statistical design and with random blocking design was performed. Planting method with/without reaping operation in the main plots and plant species in secondary plots were placed in 3 repetitions. The distance between bushes and plant line was 3 m. Reaper was used to break the soil hard pan at 30-40 depth. Dry planting was done in March. In addition, irrigation was done 3 times in the first year. During the research project and in the final stage of annual growing, growth measuring was done by eliminating side effects for survival, the highest growth and crest diameter. Furthermore, fodder harvesting was done by 60% of production per year by cutting and weighing. It is necessary to note that the number of bush per plot was 28 ones and in 1 repetition treatment 168 bushes, in 3 repetition 504 bushes and for 2 species under study was 1008 all together, which was annually measured after eliminating sidelines for every species per plot was 10 bushes and in 1 repetition 60 bushes. Analysis of variance was done on the statistical data for each year (by using MSTATC software). Finally, the most appropriate method of planting and species was identified based on the results of data analysis of 5 years of research conduction.

## RESULTS

In order to investigate the effect of operation with/without reaping on the survival of *Atriplex canisence* and *Suaeda fruticosa* species, the obtained data from this experiment were analyzed using split plot statistical design and with totally randomly blocks.

***Atriplex canisence***

As it is indicated in Table 2 (analysis of variance), the difference between with/without reaping treatment is significant at 1% level of probability.

**Table 2. Analysis of variance *Atriplex canisence* feature under levels of different reaping and year**

| MS | | | | df | S.O.V |
|---|---|---|---|---|---|
| Provender production | vegetation canopy | Height growth | Survival | | |
| 321.9 | 23.28 | 2.72 | 1.72$^{**}$ | 2 | Block |
| 20767.2 $^{*}$ | 4433$^{**}$ | 98 $^{**}$ | 26.88 $^{**}$ | 1 | Treatment |
| 3770.6 | 18.8 | 1.16 | 1.72 | 2 | Error of treatment |
| 193689.8 $^{**}$ | 1172.6 $^{**}$ | 88.22 $^{**}$ | 0.22 | 2 | Year |
| 2551.4 | 76.33 $^{*}$ | 4.67 | 0.22 | 2 | Year × Treatment |
| 1294 | 15.8 | 2.03 | 0.056 | 8 | Error |

** and **: significant in level of 5% and 1%*

As the variance analysis of vegetation canopy diameter shows (Table 2), there is significant difference at 5% level of probability between the different years, at 1% level of probability with/without reaping treatmentand also at the 5% level of probability for the interactional effect of years and operation with/without reaping.

**Table 3. Mean comparison of simple effects *Atriplex canisence* feature under reaping and non-reaping**

| Provender production | vegetation canopy | Height growth | Survival | Treatment |
|---|---|---|---|---|
| 480.9 $^{a}$ | 78.5 $^{a}$ | 57.4 $^{a}$ | 10$^{a}$ | Reaping |
| 413 $^{b}$ | 47.2 $^{b}$ | 52.7 $^{b}$ | 7.5$^{b}$ | Non reaping |

*In each column, means with the similar letters are not significantly different at 5% level of probability*

The difference between different years and the interactional effect of years and with/without reaping is not significant in terms of the survival of *Atriplex canisence* species. The comparison between two means indicates that operation with reaping treatment ($\bar{x}$=10) is superior to operation without reaping treatment ($\bar{x}$=7.56) (Table 3).

**Table 4. Mean comparison of simple effects *Atriplex canisence* property under effect of different year**

| Provender production | vegetation canopy | Height growth | Survival | Year |
|---|---|---|---|---|
| 263.9 $^{c}$ | 47.55 $^{c}$ | 51.33$^{c}$ | 9 $^{a}$ | 2002 |
| 454 $^{b}$ | 66.1 $^{b}$ | 55 $^{b}$ | 8.67 $^{b}$ | 2003 |
| 623 $^{a}$ | 74.9 $^{a}$ | 59 $^{a}$ | 8.67 $^{b}$ | 2004 |

*In each column, means with the similar letters are not significantly different at 5% level of probability*

The comparison between the means of vegetation canopy diameter in the years 2002-2004 (Table 4), reveals that the maximum diameter of vegetation canopy in years 2002-2004 were $\bar{x}$: 1.66 and 74.9 cm respectively and the minimum diameter of vegetation canopy in 81 was $\bar{x}$: 47.55 cm.

**Table 5. Mean comparison of interaction effect of treatment and year on *Atriplex canisence* feature**

| Provender production | vegetation canopy | Height growth | Survival | Year | Treatment |
|---|---|---|---|---|---|
| 307$^{d}$ | 60.03 $^{b}$ | 52.67 $^{c}$ | 10 $^{a}$ | 1381 | |
| 502.3 $^{b}$ | 85.7 $^{a}$ | 57.67 $^{b}$ | 10 $^{a}$ | 1382 | Reaping |
| 633.3 $^{a}$ | 90 $^{a}$ | 62 $^{a}$ | 10 $^{a}$ | 1383 | |
| 220.6$^{e}$ | 35.1 $^{d}$ | 50 $^{c}$ | 8 $^{b}$ | 1381 | |
| 405.7 $^{c}$ | 46.6 $^{c}$ | 52.33 $^{c}$ | 7.33 $^{c}$ | 1382 | Non reaping |
| 612.67 $^{a}$ | 59.87 $^{b}$ | 56 $^{b}$ | 7.33 $^{c}$ | 1383 | |

*In each column, means with the similar letters are not significantly different at 5% level of probability*

As the variance analysis of the data obtained from the highest growth of *Atriplex canisence* species (Table 5) shows that the difference between with/without reaping treatment is significant at 1% level of probability. The difference between years and the interactional effect of years and with/without reaping on the species height growth is not significant. The highest amount of height growth is seen in operation with reaping treatment in year 2004 ($\bar{x}$=62cm).

**Table 6. Analysis of variance *Suaeda fruticosa* feature under levels of different reaping and year**

| MS | | | | df | S.O.V |
|---|---|---|---|---|---|
| Provender production | vegetation canopy | Height growth | Survival | | |
| 321.9 | 61.9 $^{*}$ | 192.9$^{*}$ | 0.056 | 2 | Block |
| 20767 $^{**}$ | 13905 $^{**}$ | 61.97 | 2.7 | 1 | Treatment |
| 3770 | 303 $^{**}$ | 9.5 | 0.056 | 2 | Error of treatment |
| 193689 $^{**}$ | 1004 $^{**}$ | 2465.3 $^{**}$ | 0.22 | 2 | Year |
| 2551.4 | 47 | 62 | 0.22 | 2 | Year × Treatment |
| 1294/3 | 12 | 43.3 | 0.556 | 8 | Error |

** and **: significant in level of 5% and 1%*

***Suaeda fruticosa***

The variance analysis of *Suaeda fruticosa* survival (Table 6) indicates that the difference between the different years, operation with/without reaping and also the interactional effect of years is not significant.

The variance analysis diameter of vegetation canopy of *Suaeda fruticosa* species (Table 6) shows that the difference between different years is significant at 5% level of probability.

**Table 7. Mean comparison of simple effects *Suaeda fruticosa* feature under reaping and non-reaping**

| Provender production | vegetation canopy | Height growth | Survival | Treatment |
|---|---|---|---|---|
| 480.9 [a] | 94 [a] | 68.5 [a] | 10 [a] | Reaping |
| 413 [b] | 38.4 [b] | 64.8 [a] | 9.2 [a] | Non-reaping |

*In each column, means with the similar letters are not significantly different at 5% level of probability*

The difference between different years and the interactional effect of year and with/without reaping on the *Atriplex canisence* survival is not significant. The comparison of the two means show that operation with reaping treatment ($\bar{x}$=10) is superior to operation without reaping treatment ($\bar{x}$=9.2) (Table 3).

**Table 8. Mean comparison of simple effects *Suaeda fruticosa* feature under effect of different year**

| Provender production | vegetation canopy | Height growth | Survival | Year |
|---|---|---|---|---|
| 263.9 [c] | 54.1 [c] | 43.8 [b] | 9.8 [a] | 2002 |
| 454 [b] | 64.6 [b] | 73.8 [a] | 9.5 [a] | 2003 |
| 623 [a] | 79.8 [a] | 82.4 [a] | 9.5 [a] | 2004 |

*In each column, means with the similar letters are not significantly different at 5% level of probability*

The comparison between the means of vegetation canopy diameter in the years 2002-2004 (Table 8), reveals that the maximum diameter of vegetation canopy in years 2002-2004 were $\bar{x}$: 64.6 and 79.8 cm respectively and the minimum diameter of vegetation canopy, in 2002 was $\bar{x}$: 54.1 cm.

**Table 9. Mean comparison of interaction effect of treatment and year on *Suaeda fruticosa* feature**

| Provender production | vegetation canopy | Height growth | Survival | Year | Treatment |
|---|---|---|---|---|---|
| 307.1 [d] | 80.5 [c] | 49.4 [b] | 10 [a] | 2002 | |
| 502.3 [b] | 95.6 [b] | 73.8 [a] | 10 [a] | 2003 | Reaping |
| 633.3 [a] | 105.8 [a] | 82.4 [a] | 10 [a] | 2004 | |
| 220.6 [e] | 27.7 [e] | 38.2 [b] | 9.67 [a] | 2002 | |
| 405.7 [c] | 33.6 [e] | 73.8 [a] | 9 [a] | 2003 | Non-reaping |
| 612.7 [a] | 53.8 [d] | 82.4 [a] | 9 [a] | 2004 | |

*In each column, means with the similar letters are not significantly different at 5% level of probability*

In addition, the difference between with/without reaping treatmentis significant at %1 level of probability and the maximum amount of vegetation canopy diameter ($\bar{x}$=95.6 cm) with reaping treatment obtained in year 2004 (Table 9). The difference between the interactional effect of year and with/without reaping treatment is not significant for diameter of vegetation canopy of *Suaeda fruticosa.* The variance analysis of the data obtained from the highest growth of *Suaeda fruticosa* in years 2002-2004 (Table 9) show that between different years in terms of height growth at 5% level of probability and between with/without reaping treatment at the 1% level of probability is significant. The maximum height growth ($\bar{x}$=82.4 cm) is for with/without reaping treatment in year 2004. Also, the difference between the interactional effect of year and operation of with/without reaping is significant at 5% level of probability.

## DISCUSSION

Analysis of variance of different operation with/without reaping treatment on the *Atriplex canisence* survival is significant but it is not significant for *Suaeda fruticosa.* The difference between with/without reaping operation treatment on vegetation canopy the growth of two species under the study is significant but the interactional effect of year and with/without reapingoperation is significant for *Atriplex canisence* species but not significant for *Suaeda fruticosa* species. Also, the results obtained in subsequent years of the study showed that with reaping operation is effective on the height growth of both species. On the other hand, the interactional effect of years and with/without reapingoperation is only significant for *Suaeda fruticosa* species but is not significant for *Atriplex canisence.* The variance analysis related to the amount of dry fodder production of the species under the study in year 2002-2004 shows that operation with reaping treatment was effective on the amount of production in both species, however, the interactional effect of year and treatment is not significant for both *Atriplex canisence* and *Suaeda fruticosa* species.

## CONCLUSION

Given the purpose of study, choosing the most appropriate method and plant species, the amount of fodder production is economically important. Thus it is suggested that the survival and fodder production of Suaeda fruticosa species was considerable (the average production of each bush equals 768/167 g). Accordingly this plant species is recommended in biological revival of the region surrounding fields and garden of Kesht-va-Sanaat Isar Fajr of Kashan.

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