

**EFFECT OF INBREEDING AND SELECTION ON
YIELD AND ITS COMPONENTS IN SOME
ALFALFA POPULATIONS**

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تأثير التربية الداخلية والانتخاب على المحصول ومكوناته في بعض عشائر البرسيم الحجازي

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INTRODUCTION

Alfalfa Medicago sativa L., is a perennial forage legume crop. It characterized with its nutritive quality and quantity where it gives highest production of green forage yield and dry forage yield as well as higher values of crude protein, ether extract and ash with lower value of crude fiber. Because of its tolerance to various stressed environmental conditions, it well established along the world.

In order to decrease the gap between the production of forage productions and its consumption in Egypt, it cultivated in the newly reclaimed soil to face the shortage of the production especially in summer season.

Therefore, great efforts has been directed by the breeder, towards developing suitable and promising alfalfa genotypes which have high production, good quality and good growth performance under different climatologically.

The success of any breeding program depends on the amount of genetic variability available in the germplasm pool and the information about the characters associated with forage yield.

Therefore, collection, unifications and evaluation of diverse local genotypes or introduced cultivars may help the plant breeders to construct effective breeding program.

This work aims to evaluate 23 collected populations from different locations in Egypt as compared with the three commercial varieties for forage yield and its components and to study the effect of selfing and selection on forage and seed yield and its components as well as estimate some genetic parameters i.e GCA, heritability, path coefficient analysis and-----etc to identify the best genetically, diverse which can be used in alfalfa breeding program.

REVIEW OF LITERATURE

The review of literature in the present study will be demonstrated under four main concepts as follow:-

A- Populations evaluation.

B- Correlation and path coefficient.

C- Heritability.

D – General combining ability and inbreeding depression.

A- Populations evaluation:-

El-Saiaad (1981) showed that crude protein was decreased by increasing the heights of alfalfa plants from 30 cm to 60 cm. Crude fiber showed the opposite trend. Ash was decreased with increasing the height of plants from 50cm to 60 cm.

Falcinelli and Veronesi (1986) studied eighty five clones, each clones derived from a single plant of the ecotype of casalina, as spaced plant for, dry matter per plant, seed yield per plant and height of the tallest stem. Stem height differed significantly among clones. They suggested that selection for dry matter yield could be done on the basis of stem height.

Younis *et al* (1986) tested forty five varieties of alfalfa under sandy soil in Ismailia and concluded that some local varieties (Sewa1 and Sewa2) gave the highest values for crude protein, green and dry yield as compared with the other introduced and local alfalfa varieties, as well as low values of crude fiber %.

Rummey *et al* (1987) used 19 strain crosses which produced from 21 cultivars and found that significant differences were appeared among reciprocal strain crosses as an indicator of parent crossing. On the other hand several parental sources were potentially low yielding but reciprocal, strain cross from these sources yielded similarly to the reciprocals from better adapted parental sources.

Volenec *et al* (1987) studied the influence of plant populations on alfalfa yield components and they found that selection for genotypes with high yield per shoot may be an effective means of increasing forage yield.

Rammah *et al*(1988) evaluated 15 introduced and one local of alfalfa varieties during three successive years and showed that C/M2029 spring field, Siriver, Cuflo, C/W8037, Diabla verde and Baron RF3138 varieties gave the highest values of green yield, dry yield, crude protein and ash as well as low values of crude fiber % in sandy soil. On the other hand, the varieties Resis and Sewa gave the lowest values of green and dry yield, high in crude protein percent and low values of crude fiber.

Rumbaugh *et al* (1988) studied 28 traits for 146 genotypes of alfalfa collections from Morocco, and reported that alfalfa breeders selecting for quantitatively inherited adaptive traits could pool the accessions from five or fewer populations with little risk of significantly decreasing the variability.

Geweifel (1990) found that under Egyptian conditions, eleven alfalfa cultivars were differed significantly in dry forage yield.

Manyawu *et al* (1991) evaluated thirty alfalfa varieties and they found that baron variety out yielded than the other varieties in dry matter yield.

Rumbaugh and Pendery (1991) studied the stability of forage yield of alfalfa clones grown with five associate species and found that alfalfa was the most competitive associate species, some clones were phenotypically more stable than others.

Abd El-Halim *et al* (1992) found that crude protein was not affected by the growing season. Crude fiber and ash were generally higher in winter growth than in the spring growth of most cultivars. Ether extract was generally higher in the spring growth than in winter growth.

Mousa *et al* (1996) evaluated some growth characters, i. e. plant height, root length, number of tillers / plant, leaf /stem ratio and yield of six alfalfa varieties (five local varieties and the introduced variety awl

605) during three successive years. Generally, results indicated that significant differences were observed between alfalfa varieties in plant height, number of tillers /plant, leaf / stem ratio and fresh and dry yield for individual cutting in the first and second years and its combined analyses. In the meantime, significant differences were observed for crude protein, crude fiber and ash yield. Also, the same traits affectedly by seasonal growth in both years and its combined, since autumn season significantly than summer, spring and winter season. The interaction affect of varieties and season of growth was significant for all traits.

Abdel-Halim *et al* (1998) evaluated six cultivars of alfalfa included Giza1, Ismailia1 and WL605 for some agricultural traits. They found that Giza1 and Ismailia1 were the most productive cultivars in winter, spring and summer. Whereas, the highest forage production for all tested cultivars were in autumn season at Ismailia location.

Annicchiarico *et al* (1999) evaluated 16 landino parent genotypes of *T.repens* from different landraces and found significant differences between them for dry matter over two years and seed yield in second year.

Ilieve and Kertikova (1999) studied five alfalfa lines and found that crude protein variation was low among them. Three selfing cycles and selection resulted high productivity with good forage characteristics.

Abdel –Galil *et al* (2000) evaluated the productivity of dry yield for seven alfalfa cultivars under different environments in Ismailia and New Valley locations for two years. In the New Valley location, higher production was obtained in spring season in both years with no significant differences among cultivars. The total dry yield ranged between 12.15 to 13.74 t/fed, in the first year and between 14.22 to 16.08 t/fed, in the second year.

Aguilar *et al* (2000) used 45 cultivated populations of alfalfa and found that significant differences between populations for the characters i.e number of inflorescences, seed number per plant and seed weight per

inflorescence in the first experiment. While, the populations x years interaction was only significant for the seed yield per plant in the second experiment.

Aguilar *et al* (2001) evaluated seed yield and its components for a set of 12 cultivars at four locations during three years. They found effect of years, cultivars and their interaction were significant for seed weight, number of seeds pods, seed weight /inflorescences and number of pods /inflorescence (except of the main effect of year on seed weight).

Falcinelli *et al* (2001) Influenced of seed weight on the initial growth stages of four lucerne populations was evaluated during 2000 season. The difference between the four varieties was significant for these traits. The two cultivars capital and classes had average seed weights of 2.45 and 2.76 mg, respectively, while both Equip and Casales had average weights (1.99 mg).

Lukic *et al* (2001) evaluated seed yield performance of nine lucerne varieties (four from Yugoslavia, one from Macedonia, two from Croatia, one from USA and one from France). They found that, number of productive branches per plant ranged from 38.0 to 56.6, from 19.3 to 25.5 for the number of stem per plant, from 1.5 to 2.10 tones/ha for biomass yield, 6.6 to 9.7 for the number of pods per inflorescence, from 735 to 1399 for the number of pods per plant and from 2.3 to 3.5 for the number of seeds per pods.

Abo Fetich (2002) used eight alfalfa varieties to examine inter and intra varietals variability in tolerance of frequent cutting, as well as estimated the performance of clones selected for tolerance to frequent cutting. No significant differences among varieties in response to the frequent cutting schedule, but these was sufficient variability among individual plants within varieties allowing to identification of tolerance (T) and sensitive (S) plants groups. Significant differences were detected between T clones at all cuts for all traits (plant height, dry leaf, dry stem and leaf /stem ratio). But the S clones were narrowly different in yield performance at all cuts except the second cut and total yield.

Aparicio *et al* (2004) determined the optimum harvesting time of the lucerne cultivars (Valenciano and Oaxaca) during the different seasons of the year. The treatments consisted of successive cuts at weekly intervals during a regrowth cycle (8 weeks) in each season of the year. They found that cumulative herbage harvested had the following seasonal pattern Spring > Winter > Summer > Autumn. The results suggested that ,in order to obtain the maximum herbage production, lucerne must be harvested at 4 -4-5 and 8 week intervals for valenciana and 6 , 4 , 5 and 6-week intervals for Oaxaca during spring ,summer, autumn and winter respectively.

Ates and Tekel (2004) studied morphological characters, herbage yield, dry matter yield and yield of the lucerne cultivars and found that the maximum of main stem height, seeds per pod, dry matter yield and seed yield were 78.69cm, 6.57, 20.06 t ha⁻¹ and 0.49t ha⁻¹, respectively.

Hamed (2004) evaluated 14 local alfalfa populations for quality and forage yield production during three successive years. Significant differences were detected among populations during study years and growing seasons for all traits. In general ,the best local alfalfa populations 1 ,5 ,7 ,11 and 14 which gave the highest green and dry yield, quality ,crude protein, ash, ether extract and lowest fiber percentage. Highest green and dry yield was obtained during winter and spring season in every year under study. The main effects of population, season, years and their interaction were significant for all traits except fiber percentage. It is values ranged from 42.2 to 50.2, 61.0 to 130.8, 36 to 48.8, 6.7 to 20.7 and 1.39 to 6.69 for plant height, number of tillers, dry leaf/stem ratio, fresh yield and dry forage yield, respectively.

Hua *et al* (2004) studied performance and the relationships between yield and its components of 10 alfalfa varieties. The greatest increase in dry matter yield occurred before the first cut, and the fastest daily average increase in height occurred before the second cut. The coefficient of variance for yield properties among varieties, from highest to lowest. Among years, the highest coefficient of variance for total dry

matter and leaf area occurred in the 1st and 4th years and in the 2nd year for daily increase in height.

Ibrahim (2005) estimated the variability in forage yield and yield related in 169 alfalfa clones, and reported that clones differ widely in all traits in each season and over seasons. Clones were significantly superior to check varieties in average performance per season and over seasons for forage yield and plant height. Over all clones, forage production was higher in spring and summer seasons than in winter and full ones. Also, genetic variation among clones was detected for crude protein, plant height, number of shoots, green and dry forage yield.

Karagic *et al* (2006) determined the dependence of seed yield on the cutting of alfalfa. Four cutting were examined, early (5May) medium (15May) late (25May) and two cuts (5May and 5Jue). Results revealed late cut achieved the best balance among yield components and the highest seed yield. The single early and medium cuts produced lower yield. Also they found that seed yield recorded highest correlations with number of plants/area, number of productive stems per unit area, number of pods per raceme and the number of seeds /pod.

Sengul and Sengul (2006) found significant and positive effects of plant height, number of pods / plant and seed number / pod, among 30 landraces of alfalfa. They suggested that these yield components may be good selection criteria to improve seed yield of alfalfa.

Abdel Galil (2007) used two newly synthetics and three commercial alfalfa cultivars to study the productivity of forage yield during different years. He found significant differences of years, varieties and their interaction for forage yield, dry yield, plant height and number of tillers. The combined analysis over the two years revealed that syn₂ cultivar had higher significantly fresh forage yield than the other genotypes, followed by Syn₁. Also, Syn₂ was higher in plant height, number of tillers and leaf to stem ratio than other genotypes.

Annicchiarico (2007) evaluated 390 genotypes belonging to ten landraces from different locations. They found significant variation for leaf / stem ratio among varieties but not among landraces.

Hefny (2007) used 13 alfalfa populations (local and exotic groups) to study the variation among varieties, cuts and its interaction on yield and some characters. He found significant effect populations on plant height, number of shoot / plant, protein % and forage yield. The landraces group surpassed in their mean performance for most of the measurable traits followed by the local group.

Popovic *et al* (2007) estimated the variability of yield and yield components as well as some quality traits (protein content, dry matter, fiber and ash content as well as leaf / stem ratio). Variability coefficients were high for yield components and yield while quality traits showed relatively low variation.

Wu *et al* (2007) tested 84 lines of alfalfa with different origins during five years and found significant differences in forage yield and growth characters between them.

Farshadfar and Farshadfar (2008) reported that analysis of variance for some morphological traits i.e plant height, tiller number, dry yield and dry leaf / dry yield reflected significant differences among 18 alfalfa genotypes.

Stanisavljevic *et al* (2008) studied the effect of four alfalfa cultivars under two plant densities on dry matter yield and content of crude protein and found significant effect of dry matter and content of crude protein among the four studied cultivars.

B - Correlation and Path coefficient

Liang and Riedl (1964) used ten crosses of alfalfa to estimate simple correlation and path coefficient analysis for seed yield and its components. Positive correlation was found between both plant height and number of stems with forage yield. They added plant height and number of stems had the greatest influence on forage yield, but number of leaves and number of internodes had only minor effects.