

Alfalfa Varieties From the 1920s to the 1980s: Comparison of Forage Yield During the Seedling Year

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Between 1920 and 1985, average hay yields in Arizona nearly tripled. Many factors could have been responsible for these yield gains, but improvements in yielding ability or pest resistance in varieties and changes in cultural practices are the most common explanations given. Many different varieties of alfalfa have been grown in Arizona over the last 60 years. However, it is really not clear just how much better today's varieties perform. For example, current varieties are more pest resistant, but are they better yielders when pests are not present?

Are newer alfalfa varieties necessarily better yielders?

To develop objectives for alfalfa breeding for the 1990's and beyond, we decided to look back at the varieties of the last 60 years and ask the question "Why are today's alfalfa varieties better?" More specifically, has there been a steady improvement in yield in non-winter-dormant alfalfa varieties that has accompanied improved pest resistance?

Before approximately 1956, most alfalfa varieties used in the Arizona were really "farmer-improved" populations, not the products of intensive plant breeding efforts. Varieties in this category, such as Chilean, Hairy Peruvian, African and Indian, formed the basis of the Arizona alfalfa industry for the first half of this century. After the appearance of the spotted alfalfa aphid in the mid-1950's, plant breeders began active programs to develop insect and disease (pest) resistant varieties for the Southwest, using the farmer-improved populations as their starting materials. Examples of widely-grown varieties in this group and their pest resistances include: Lahonton and Mesa-Sirsa (spotted alfalfa aphid), Moapa-69 (fusarium wilt), CUF 101 (blue alfalfa aphid and pea aphid), and Lew (stem nematode).

What has happened to yield with the emphasis on pest resistance?

Yield thresholds are apparently being approached in some crops, with corn probably the best example. Because we are unsure just how much improved cultural practices and pest resistances have improved alfalfa yields, we cannot say for sure whether we are approaching a yield threshold in this crop. With so much emphasis placed on improving pest resistance since the mid-1950s, it seems reasonable to assume that inherent yield (yield in the absence of pest attack) may not differ greatly between pre- and post-1956 alfalfa varieties.

By growing representative varieties from different eras under uniform conditions where the effects of pests are minimized, it should be possible to assess any changes in inherent yielding ability that have occurred over time. In 1987 we began such an experiment using 13 cultivars representing roughly three eras: (1) Pre-1956 (Chilean, Hairy Peruvian, African, Indian); (2) 1956-1964 (Lahonton, Moapa, Zia, El Unico); and (3) 1966-1980 (Mesa-Sirsa, Moapa 69, UC Cargo, Lew, CUF 101).

Original seed of these varieties was sown in 2 meter rows in October, 1987 in Tucson. Results of laboratory germination tests were used to adjust seeding rates to achieve equal stands in all entries. Forage harvests were begun in this four-replication experiment in January 1988. Data from the first six harvests of the seedling year (January to July) are

included in this report. Weekly measurements of stem elongation were also conducted for the 17 May to 14 June and the 15 June to 12 July regrowth periods.

Seedling year results

Several interesting observations have been made during the first six months of this study. For example, only African, Chilean and Lahonton have yielded significantly less than the standard check varieties of the the 1980's, Lew and CUF 101 (Table 1). Surprisingly, the 40+ year-old variety Indian has yielded about the same as CUF 101. Measurements of mean stem regrowth for four-week regrowth periods in the spring and early summer have shown that this easily measured trait is positively related to seasonal yield ($r=0.45$). However, the correlation is probably too small to be of much value in predicting yield for breeding purposes.

Overall, little variation was observed among varieties in mean rates of stem regrowth for the entire 4-week regrowth period (Table 1). Much more variation was present in regrowth rates during the first post-harvest week. First week stem elongation was positively correlated with yield ($r=0.54$), while values for regrowth in weeks two through four ranged from $r=-0.47$ to $+0.43$. First week stem regrowth may prove useful in future selection for improved yield.

Observations of dormancy, yield, regrowth and stand persistence will continue in this experiment during 1988 and 1989. An additional test containing the same entries was established in the spring of 1988. At present we can conclude that many ancestral alfalfa varieties from the 1940s and 1950s appear to have very similar yield potential to present-day, pest resistant varieties when pests are not present.

These data suggest that no plateaus have apparently been reached in seedling year yields in alfalfa. Further breeding effort directed toward this trait, along with emphasis on improved insect and disease resistance, may be worthwhile and could result in even higher hay yields.

Table 1. Total forage yield (six harvests, January to July, 1988) and stem regrowth of 13 alfalfa varieties representative of those grown in Arizona during the last 65 years.

Variety	First year available	Special characteristics	Forage yield		Stem regrowth	
			Kg/plot	(% of Lew)	4 wks ¹	1st wk
					---- cm/day ----	
Chilean	ca. 1910	—	9.54	(79)	2.67	1.94
Hairy Peruvian	1923	Winter growth	10.72	(89)	2.71	2.19
Indian	1943	Winter growth	11.57	(96)	2.85	3.41
African	1945	Winter growth	9.84	(82)	2.81	3.55
Lahonton	1954	Resis. to stem nematode and spotted alfalfa aphid	9.04	(75)	2.77	1.93
Moapa	1957	Resis. to spotted alfalfa aphid	11.35	(94)	2.93	3.79
Zia	1958	Resis. to spotted alfalfa aphid	10.98	(91)	2.77	1.93
El Unico	1964	Tolerant of downy mildew	12.08	(100)	2.79	3.19
Mesa-Sirsa	1966	Tolerant of downy mildew	12.28	(102)	2.92	3.27
Moapa-69	1971	Resis. to spotted alfalfa aphid	11.35	(84)	2.68	3.42
UC Cargo	1975	Tolerant of scald	12.96	(108)	2.82	3.28
Lew	1976	Resis. to stem nematode	12.05	(100)	2.84	2.98
CUF 101	1980	Resis. to blue alfalfa aphid	11.80	(98)	2.84	3.41
(LSD - 5%)			(0.21)		(0.13)	(0.39)

¹Mean for 4-week regrowth period.