

Specific Stem Weight in Alfalfa - A Possible New Approach to Increasing Yields

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Improvement of alfalfa yield and quality are important considerations for both producers and utilizers of alfalfa forage. Over the years, alfalfa improvement has resulted in high yield increases due primarily to breeding for disease and insect resistance and alterations of leaf stem ratio, with emphasis being placed on leaf weight.

Limited research in the area of alfalfa quality has generally been associated with the study of leaf characteristics and attempted improvement in the digestibility of stems. However, when we consider that from 50 to 70% of the alfalfa plant is comprised of stems, the impact of potential improvement in both alfalfa stem quality and total yield may be significant.

It appears worthwhile, therefore, to evaluate the possibility of stem improvement as a means of improvement of both alfalfa yield and quality. In order to observe the variability of specific stem weight within a given population, 110 alfalfa plants were selected from an established field of 'Lew' alfalfa. We were interested in observing what, if any, morphological differences existed among the stems in addition to the variability in stem weight in the variety Lew.

Specific stem weights of the 110 alfalfa plants ranged from 6.0 to 21.0 mg/cm. The wide range of stem weights indicated that there was indeed significant variability among the alfalfa population. Yield and specific stem weight differences of the total population coverage and a selected plants for the three harvests are shown in Table 1. There was an 8 fold yield difference between the highest and lowest producing plants in Harvest 1, 20 fold difference in Harvest 2 and 4 fold difference in Harvest 3. Selection and identification of alfalfa plants with high specific stem weight during the "summer slump" may be an effective means of increasing yields during this normally low productive period.

Table 1. Yield and Specific Stem Weights of Selected 'Lew' Alfalfa Plants

| | Harvest 1 | | Harvest 2 | | Harvest 3 | |
|-------------------------------------|-------------------------------|----------------------|-------------------------------|----------------------|-------------------------------|----------------------|
| | Specific stem weight mg/cm | Yield-Wt plant gm | Specific stem weight mg/cm | Yield-Wt plant gm | Specific stem weight mg/cm | Yield-Wt plant gm |
| Total Population (av 110 plants) | 15.3 | 8.3 | 11.9 | 7.2 | 7.2 | 6.6 |
| Clone # 95 | 21.0 | 25.06 | 18.0 | 20.55 | 7.3 | 9.17 |
| Clone # 54 | 20.0 | 10.59 | 13.3 | 15.59 | 11.3 | 15.54 |
| Clone # 93 | 17.3 | 14.03 | 26.0 | 17.02 | 9.3 | 7.98 |
| Clone # 75 | 13.3 | 4.67 | 10.7 | 1.52 | 4.7 | 1.43 |
| Clone # 2 | 14.7 | 3.12 | 4.0 | 1.18 | 6.7 | 2.20 |

Nitrogen Fixation Efficiency of Alfalfa Under High Temperatures and Saline-Alkali Soils

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Alfalfa, like most legumes, has an advantage over most crops in that it is able to produce its own nitrogen. This occurs as a result of the relationship with *Rhizobium meliloti* bacteria. The bacteria enter the plant root hair through an infection thread, begin multiplication and form nodules. This symbiotic association is responsible for converting atmospheric nitrogen into a form that is usable by the plant. Under ideal conditions, the amount of nitrogen fixed ranges from 40 to 240 pounds per acre annually with alfalfa. Adding a commercial preparation of *Rhizobium* bacterial inoculant at planting time ensures the presence of desirable bacteria in the proximity of the developing legume root system. Most of the symbiotically fixed nitrogen is removed with harvest of the forage of the legume, but there is some chance that actively growing alfalfa may excrete nitrogenous compounds into the soil.

Examination of alfalfa plants during the growing season over a number of locations revealed that under Arizona conditions very few alfalfa plants had nodules that were actively fixing nitrogen. Two studies are currently underway to determine the most effective way of overcoming the failure of alfalfa plants to nodulate.