

POTENTIAL OF MEXICAN ALFALFAS IN THE SOUTHWEST

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There are approximately one-half million acres (200,000 hectares) of alfalfa grown in Mexico. Sixty to sixty-five percent of the acreage is located in the central highland regions surrounding Mexico City. Major consumers of this crop are dairy animals, both cows and goats, and to a lesser extent rabbits and poultry. In Mexico most of the alfalfa is harvested and fed as fresh-cut feed or as baled hay. However, dehydrated alfalfa meal, supplemented with dehydrated marigold flower heads, is an important ingredient in poultry feed. The marigolds impart the deep yellow color desired in both eggs and meat of poultry.

Except for the rainy season, which usually extends from early July through mid-October, the climate of the highlands of central Mexico is nearly ideal for the production of alfalfa. Eleven to twelve harvests can be made each year. Alfalfa is a popular crop with the farmer because of the large demand by the Mexico City market and because it provides a steady source of income throughout the year. Yields of fresh-cut alfalfa in excess of 45 tons per acre per year can be produced (approximately 10.2 t of hay at 12% moisture).

The author spent twelve months in Mexico from July 1976 to June 1977 studying the major problems associated with alfalfa culture in that country, in addition to searching for germplasm which possessed tolerance or resistance to those problems. Such alfalfas have great potential for incorporation of their desirable attributes into alfalfas adapted to southwestern United States. Major effort in this regard was placed on the following disease, insect, and cultural problems.

Insect Pests of Alfalfa In Mexico:

1. Spotted Alfalfa Aphid

Although all of the Mexican strains or ecotypes of alfalfa are highly susceptible to the spotted alfalfa aphid (SAA), no serious outbreaks were observed under field conditions. Occasionally plants grown in the greenhouse become heavily infested with SAA. When this occurred, they were controlled by applying insecticides.

2 The Bajio "Blue Alfalfa Aphid"

An aphid that appeared identical to the Blue Alfalfa Aphid (BAA) found in Arizona and California is a serious problem throughout much of the highland area of central Mexico. It was by far the most common insect pest found causing damage to alfalfa in this region primarily during December and January. The BAA in Mexico prefers to feed on the upper part of alfalfa stems. Often the aphid population becomes so dense that it completely covers the terminal portion of the stem. The term "shingled" has been used to describe these dense aphid populations. Prolonged feeding by heavy populations of the Bajio BAA caused the leaves and upper stems to droop and become stunted. When the aphids were removed from the plants, either by use of insecticides or mechanically, the plants quickly recovered and resumed normal growth.

In a greenhouse test at Celaya Guanajuato, seedlings of ten varieties of alfalfa were infested with a large population of the Bajio BAA shortly after seedling emergence. Aphids were added at 2-day intervals to maintain high populations on the alfalfa seedlings. The plants were severely stunted as long as the aphid population was high. When the aphids were removed, the seedlings began to grow normally. There were no seedlings killed by this species of aphid after a 3-week period of heavy infestation.

A collection of non-stunted plants was obtained from a farmer's field which was heavily infested with aphids. The selected plants were established in a small,

isolated plot for seed production. A sample of these aphids was sent to an insect taxonomist in Mexico City for identification. It is my opinion that this aphid is a Biotype of the Blue Alfalfa Aphid. However, comparative tests between the Mexican and U.S. BAA's are needed for positive identification. Mexican entomologists and alfalfa growers, claim this aphid has been a problem on alfalfa in the central highland region of Mexico for several years. From these observations and discussions, it appears highly probable that the Blue Alfalfa Aphid was established in Mexico prior to its discovery and identification in Arizona and California. It is also my opinion that it was introduced into southwestern United States from Mexico instead of from other parts of the world as theorized in earlier reports.

3 Alfalfa Root Borer (Maemactes sp)

A root boring beetle was observed on alfalfa at two locations in Mexico. It was first observed in the summer of 1975 in a field of alfalfa on the Mexican Celaya Guanajuato research station by Dr. Bill Melton, alfalfa breeder from New Mexico, Mr. Jaime Aguirre, Mexican alfalfa breeder, and the author while we were conducting a preliminary survey of alfalfa problems in Mexico. It appears that this is a new insect pest of alfalfa. Specimens were given to Dr. Floyd Werner of the University of Arizona's Entomology Department and to Dr. Charles O'Brian of the Florida A & M University at Tallahassee, Florida for identification. This insect does not appear to be a serious threat to alfalfa, in either Mexico or the United States. The larval and pupal stages are spent entirely underground inside alfalfa roots. The adults may leave the roots to mate and oviposit, but they walk very slowly and have not been observed to fly. Host plants with prominent tap roots seemed to be preferred to those with smaller, more branching root systems.

4. Leafhoppers

Several species of leafhoppers were observed in relatively large populations on alfalfa during late summer and fall. One species was very dark brown and appeared different from leafhoppers observed in southern Arizona. Collectively the leafhoppers in Mexico caused some stunting and yellowing of alfalfa foliage, especially in fields in which harvesting of the forage had been delayed several weeks beyond the normal, early-bloom stage of growth. A collection of alfalfa plants having tolerance to leafhopper feeding was made and a seed increase plot was established.

5. Lygus Bugs

Lygus bugs were often observed in the central highland region but not on the western side of the Sierra Madre Occidental mountain range in Mexico. The area has a lower elevation and higher summer temperatures than the central highland region. Mexican alfalfa workers have found the lower elevation area to be well-suited for alfalfa seed production and they are attempting to establish alfalfa seed production as a commercial enterprise. Their goal is to become self-sufficient in meeting their farmer's demand for planting seed of locally adapted varieties. Experimentally, they have produced over 1000 lbs. of seed per acre in this area.

6. Miscellaneous Insects on Alfalfa

Army worms, leaf miners, and seed chalcids have been observed causing some, but not sustained, damage to alfalfa in Central Mexico.

Diseases of Alfalfa in Mexico:

Alfalfa diseases cause great damage to the crop in Mexico. Currently Arizona and Mexican alfalfa workers, breeders and plant pathologists, are cooperating in an effort to correctly identify the major disease problems and to select alfalfa plants possessing natural resistance to those diseases from the Mexican alfalfas.

1 Phytophthora Root Rot

A very virulent strain of Phytophthora megasperma was found in many alfalfa fields

throughout the central highland area of Mexico. Initially much confusion was associated with this problem. Mexican pathologists with little or no experience with *Phytophthora*, were unable to isolate this fungus; while other ever-present, non-pathogenic fungi were found repeatedly and thus incorrectly credited as being the primary causal agents of the disease problem. Fortunately, University of Arizona Plant Pathologist, Dr. R. B. Hine, was able to make two trips to the INIA research station at Celaya during my year of work in Mexico. By using techniques developed at the University of Arizona, he was able to isolate and identify the *Phytophthora* organism.

Another factor that added to the confusion was the severity or virulence of this fungus on young alfalfa plants growing in the field. In the spring of 1977, the author visited with several farmers who were having problems in establishing satisfactory stands of alfalfa. One farmer had planted a field three times and still had a poor stand. He said he had applied 28 kgs. of seed per hectare at each planting, thus he had applied a total of 84 kgs. per hectare. This is equivalent to 75 lbs. of seed per acre. Further travel and observation revealed that the above situation was not an isolated case, in fact it soon became obvious that *Phytophthora* root rot was the major cause of alfalfa stand failures in central Mexico. Similar devastation of new plantings of alfalfa in Arizona have not been observed.

Several collections of resistant (non-infected) plants were made at various locations in central Mexico. The selected plants were taken to the nearest research station and established in isolated field plots for seed increase. Fortunately this problem can be greatly reduced by the development and use of resistant cultivars.

2. Fusarium Wilt

A very common disease problem found on alfalfa in central Mexico was caused by the fungus *Fusarium oxysporum*. This fungus causes a dark brown discoloration to appear inside the "bark" and the central "woody" portion of the alfalfa root. This fungus weakens, stunts, and eventually kills the susceptible host plant.

In selection for resistant plants, it was necessary to remove the plant from the soil, then make a cut across the root to observe for complete freedom from this brownish discoloration. In some fields, both fungi (*phytophthora* and *fusarium*) were present thus permitting simultaneous selection for resistance to both fungi

During the preliminary tour through Mexico in 1975, we thought Bacterial wilt was also an important disease problem; however, more thorough observations made in 1976 and 1977 failed to verify that assumption.

3. Foliar Diseases

Three fungi were associated with leaf diseases of alfalfa in central Mexico. The diseases were (a) common leaf spot, (b) *Stemphyllium* leaf spot, and (c) rust. These problems were prevalent during the rainy season. The high humidity and delay in harvesting caused by water-logged soils produced conditions highly favorable for the development of these diseases.

Several collections of plants relatively free of leaf spots were made: Cultivars developed from these sources should greatly improve the quality of forage produced during extended periods of high humidity.

Problems of Alfalfa Associated with Mismanagement

As mentioned previously, water-logged soils greatly aid in the development and spread of the *Phytophthora* root rot problem. Little or no effort has been exerted to develop internal drainage of water from heavy soils. It is my opinion that alfalfa stands would persist longer and be more productive if farmers would install tile, or similar, drainage systems.

Another management problem observed was that of untimely harvesting of the alfalfa

forage. Often the forage was removed too soon. Repeated harvesting of immature alfalfa in Mexico, as well as in southwestern United States, results in depletion of carbohydrate food reserves in the crowns and roots of the plant. When the critical level for survival has been reached, plant mortality is very high and the stand rapidly becomes uneconomical and must be either re-established or plowed out.

In other cases of mismanagement, the forage harvest was delayed excessively. This problem occurs more frequently where the farmer was both the producer and consumer of the alfalfa forage. Such farmers generally prefer to feed fresh-cut alfalfa to their livestock. Thus only an amount will be harvested which can be consumed each day. During periods of peak forage production, the animals are unable to consume the forage as fast as it is being produced, so a surplus develops and is left standing in the field. The longer the alfalfa is left standing beyond the optimum stage of growth for harvest, the greater the damage from leaf diseases and insects. This reduced both quality and quantity of forage which could be produced. Farmers should be encouraged to harvest the excess forage as baled hay.

Another trait which appears to have potential for use in the Arizona alfalfa breeding program is the extreme non-winter-dormant growth habit of the Mexican alfalfas. Their growth rate in late fall is considerably greater than the so-called very non-winter-dormant alfalfas of Southwestern United States.

In summary, a number of desirable traits have been observed in Mexican alfalfas. These include greater tolerance to foliar and root disease organisms, greater fall growth, and higher seed production. Hopefully the cooperative alfalfa improvement research efforts between Arizona and Mexican alfalfa scientists initiated in 1975 can be maintained so that yield and quality levels of forage may be further improved in both countries.