

PLANTAGO SEEDS. Those at right were soaked for 12 hours; those on left are normal dry seeds. Note gel around soaked seeds. Water absorbing qualities make it possible for seeds to swell to 12 to 15 times normal size.

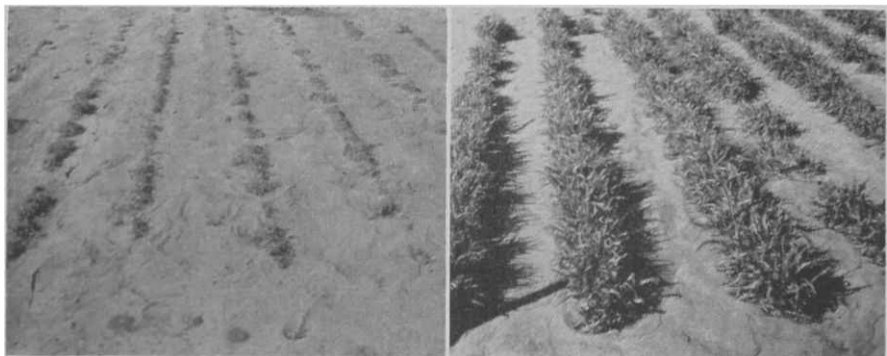


PLANTAGO OVATA plants are grasslike in appearance, with leaves in rosettes and seed stalks terminating in spikes which grow to 8 to 12 inches. Small bags are for controlling pollination to obtain "selfed" seed.

PLANTAGO--New Crop for Arizona?

By D. D. Rubis and L. D. Massman

The authors are professor of Agronomy and formerly graduate assistant in Agronomy, respectively.



PLANTS IN BREEDING nursery in Tucson in March, 1966. During previous months several frosts with temperatures as low as 17° occurred. At left, remnants of plants of commercial variety, completely frozen out. At right, new frost-tolerant variety, showing no frost damage.

Considerable evidence exists that man has used species of *Plantago* as sources of medicines since ancient times. Seeds of the European species, *Plantago psyllium* have long been known as the psyllium seed of commerce and the seed of *Plantago ovata* of India has become known as "Blond Psyllium Seed".

The United States imports annually an average of three million pounds of blond psyllium seed or husks (seed mucilage) from India and Pakistan. It is used in pharmaceuticals, principally as a laxative.

Establishing a Crop

There have been various attempts to grow plantago (*P. ovata*) as a crop in Arizona during the past 20 years. Most of the failures were due to frost damage and root rot diseases. Renewed efforts to establish plantago as a commercial crop have been made during the past three years. Although partially successful, the possibility of frost damage still plagues the crop.

Some research on plantago has been conducted at the Arizona Agricultural Experiment Station since 1952, and these efforts were intensified during 1961 to 1966. Most of the research during the past six years has been directed toward development of varieties which are frost tolerant. Varieties have been developed with these characteristics and seed is being increased. It is possible that these new varieties could firmly establish plantago as a crop in Arizona.

As a commercial crop, plantago is planted in the lower valleys of Arizona, where temperatures less than 22°F. usually do not occur. It is planted in November and harvested in May. The crop requires light sandy loam soils, well drained and free of weeds.

Plantago is planted in borders and flood irrigated;

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Dr. George Ware New Head of Entomology

Dr. George W. Ware becomes head of the Department of Entomology in The University of Arizona College of Agriculture, July 1.

Dr. Ware came to the UA a year ago from Ohio State University, where for the last 10 years he conducted research and taught courses in insect toxicology and pesticide residue analysis. Prior to that, he served four years as an independent cotton entomologist and two years as a medical entomologist in the army.

He received his B.S. and M.S. degrees from the University of Arkansas and his Ph.D. at Kansas State University. He has authored or co-authored more than 50 scientific papers, chapters and articles.

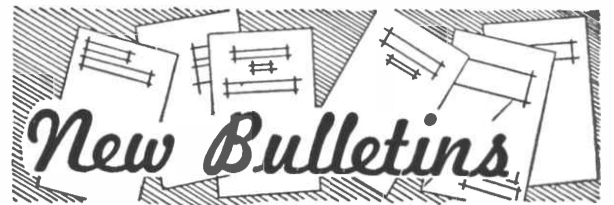
Dr. Ware plans a revised entomology program with strengthened graduate and undergraduate curricula supported by new projects in both basic and applied research. The applied aspects are aimed at solving some of the more serious insect and insect-related problems of Arizona.

As department head, Dr. Ware suc-



Dr. George Ware

ceeds Dr. Laurence A. Carruth, head of the Entomology Department the past 18 years. Dr. Carruth will remain as a professor in the department.



- C-195 Household Pests (revised)
- C-282 Home Citrus in Arizona (revised)
- A-33 Growing Grapes in Arizona (revised)

The world is full of magical things, patiently waiting for our will to grow sharper — Eden Phillpotts (in "A Shadow Passes," issued by Macmillan)

Accident — An event frequently descended from a long line of advice not listened to.

You can preach a better sermon with your life than with your lips—Oliver Goldsmith.

No man can justly censure or condemn another, because indeed no man truly knows another — Sir Thomas Browne.

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some is also planted on new unlevelled land and watered by sprinkler irrigation. Yields of experimental plantings with good stands have varied from 1000 to 1200 pounds of seed per acre.

Plant Description

Plantago ovata plants are grass-like in appearance. However, the species is not of the grass family but of the plantain family. Plants are stemless herbs with leaves in rosettes, and seed stalks (scapes) terminating in spikes at a height of 8 to 12 inches. In Arizona the plants grow as a winter annual.

Seeds average 1.5 mm. wide and 2.5 mm. long, are boat-like in shape, are reddish-brown in color, and average about 30 percent mucilage by weight. The seed mucilage is the outer layer of the epidermis of the seed coat. It can be removed from the seed mechanically. It is a white fibrous material which absorbs water readily to form a thick gelatin-like mass.

In Arizona many are familiar with the native *Plantago insularis* which is commonly known as the Indian wheatgrass of the desert. The *P. ovata* and *P. insularis* species are so similar in appearance that they are often difficult to distinguish. Their growth habits, however, are different and they do not cross naturally. *P. insularis* is more cold tolerant and root rot resistant.

Frost Tolerance and Yield

Objectives of the breeding program are to make improvements in cold tolerance, root rot resistance, height, shattering resistance and yield. Early efforts in improving *Plantago ovata* were futile because of its susceptibility to frost damage, thus the first major objective was to improve cold tolerance.

Because of the lack of variability in *P. ovata*, an interspecific cross between *P. ovata* and *P. insularis* was attempted. With special techniques a few crossed seeds were obtained in 1957 and 1958.



FROST SURVIVAL tests, Tucson, in March of 1962. Over 700 selections were planted the previous November. Excellent stands were obtained, but about 99 percent of the plants froze out in January. Staked plants (above) are survivors, saved for future interpollinating tests.

Progenies from these were grown in Tucson, where severe frosts froze out as much as 99 percent each year. By 1963 lines were obtained that withstood frosts with temperatures as low as 12°F. and had seeds of the *P. ovata* type.

From this interspecific cross new variability is now available so that improvements can be expected in yield, root rot resistance and other agronomic characteristics.

Future of Plantago

The future of plantago largely depends on development of improved varieties for economic yields and frost tolerance. Successful development of a local processing plant is also important. A few thousand acres could supply current demand.

However, development of new uses could increase this demand. Experiments conducted by various researchers elsewhere have shown the seed mucilage to be a good stabilizer in ice cream and other foods, a good sizing in printing and finishing cloth, and a good stabilizer in hair setting lotions.

Some day, because of plantago mucilage, you may be able to eat a chocolate candy bar in the heat of the Arizona sun without it melting.