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**THE TEPARY BEAN, A NEW SOUTHWESTERN  
LEGUME.**

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The development of artesian and dry-farming districts in Arizona, together with the increased use of pumped water for irrigation, have created a need for a leguminous crop which, used in rotation with grain or forage planting, will maintain the nitrogen and humus content of the soil and at the same time provide a money return which is sure and profitable. The experience of practical farmers throughout Arizona and New Mexico has for years demonstrated the fact that no crop so well fills this demand as the growing of dry shell beans. Being a country-wide food staple they have a steady market which is little influenced by local conditions other than transportation charges. As corn in Illinois, cotton in Texas or wheat in Kansas represent to their producers products of staple value, so may the dry-farmers of the Southwest, and those irrigating with artesian and pumped waters, look to the bean as a money crop which at all times may be surely and readily turned into cash.

Even within the great valleys, such as those of the Salt and Colorado rivers, where water for irrigation is both permanent and abundant, short rotations including a leguminous crop, are frequently desirable. For this purpose few crops can excel beans since, aside from their ability to add humus and nitrogen to the soil, they may afford returns of as much as forty-five to fifty dollars per acre, after occupying the land only for the short space of 90 to 100 days.

*Varieties:* Varieties of beans originating in the humid sections of the east are of but little value when grown in Arizona. They do not withstand satisfactorily the extreme aridity and heat of the air during our summer months. Out of a large number of varieties tested at Yuma during the summer of 1909, only those of southwestern origin were at all successful.

Among these southwestern varieties of beans, first tested at Yuma in 1909, certain ones were noted which gave yields far in excess of all others, including even the much prized pink bean, or frijole. Subsequent investigations developed the fact that this group of varieties was distinct from either the common kidney or snap bean (*Phaseolus vulgaris*) or the lima bean (*Phaseolus lunatus*). They were found to constitute a new species, hitherto unrecognized as a cultivated plant in botanical or horticultural literature. The varieties of this group were in all probability domesticated by the Indians from the wild southwestern species originally described by the botanist, Gray, as *Phaseolus acutifolius*. The domesticated form is, however, so distinct from the type of the wild species that it has been described by the writer as a new variety for which the name *Phaseolus acutifolius*, var. *latifolius* has been suggested.\* In its wild state, *Phaseolus acutifolius* is peculiar to the southwestern desert region. It may be found on the mountain sides and in narrow valleys from the Pecos river westward across New Mexico and Arizona and southward into the adjoining states of Mexico.

Domesticated from the neighboring canyons and cultivated in small patches, attended at best by a crude husbandry and dependent upon the precarious summer rains and uncertain floods from the mountain washes for irrigation, the tepary has lost none of its native hardiness. It has been cultivated by the Papago and Pima Indians from prehistoric times and in all probability formed one of the principal food crops of that ancient and now unknown agricultural race, the ruins of whose cities and irrigating canals are now the only witnesses of their former presence and prosperity.

Like other cultivated plants, the tepary has responded to domestication in the production of a number of more or less distinct varieties. These varieties manifest themselves chiefly in the color of the flowers and in the shape and color of the seeds. The habit of growth, foliage, and pod characters show but little change with the exception that the white seeded sorts seem to have slightly smaller leaves than do those with yellow or darker colored seeds. The writer has been able to segregate and grow more than forty distinct agricultural varieties

\* G. F. Freeman. *Southwestern Beans*. Arizona Experiment Station Bulletin No. 53 (1912).

which came originally from mixed samples of seed picked up here and there among the Lima and Papago Indians. Among all of these, the varieties most commonly grown among the Indians and probably of the greatest economic value are the white and yellow seeded sorts usually designated as white teparies and yellow teparies. In yield these two varieties are about equal. Some who are accustomed to them for table use maintain that the flavor of the white is superior. Since it is certain that no other than a white or pale pink bean can ever compete with the now almost universally eaten navy bean, it is the writer's opinion that only the white tepary should be recommended at the present time for general planting.

*How to identify the Tepary:* While growing, the tepary may easily be distinguished from the bean (*P. vulgaris*) by its more slender vines and smaller leaves. The leaves are also thinner, more smooth, narrower and more pointed at the apex than those of the bean. The pods are smaller than those of the bean, averaging about three inches long and four tenths of an inch wide. Being somewhat flattened and having thin, rather tough walls, the pods might resemble quite closely a small variety of the lima. Teparies, however, differ markedly from either the bean or the lima in the length of the stems bearing the first aerial leaves. For teparies these measure only about one sixth of an inch whereas for beans and limas they will average an inch or more. The seeds of the tepary are smaller than those of the other sorts mentioned and there are a number of minor differences which suffice to give them a distinctive appearance at least to those who are familiar with the group. The seeds of the white variety are very similar to those of the navy bean among which they would in all probability be classed on the general market. A convenient test for shelled tepary beans is to immerse them in water. They will wrinkle in 5-10 minutes; while other cultivated species commonly require more than an hour.

*The Tepary as a food for stock:* The tepary shows some promise as an orchard cover crop and as a hay plant and stock food. It is well known that prairie dogs, rabbits, ground squirrels and even ants show a decided preference for green tepary plants over other growing crops. For this reason it is often difficult to grow the tepary where these pests are numerous. Cattle eat tepary bean hay readily and thrive upon it. Though horses can be taught to eat it, they dislike it at first. The yield of hay will depend upon the fertility of the soil and the water supply. On irrigated land at Yuma, tepary beans planted Aug. 6 and harvested Oct. 31, gave a yield of air-dry hay at the rate of  $3\frac{1}{2}$  tons per acre. At the time of harvest the vines covered the ground in a dense mat about twenty inches deep

The food value of tepary bean hay is about equal to that of alfalfa. The following table, taken from analyses by C. N. Catlin, compares the food constituents in representative samples of these two crops grown during the summer of 1913.

COMPOSITION OF ALFALFA AND TEPARY BEAN HAY  
(water-free substance)

	Ash	Crude protein	Ether extract (Fats, oils, etc)	Crude fiber	Carbohydrates (Starch, sugar, etc)
Tepary hay . .	10 52	14 45	3 19	24 53	47 31
Alfalfa hay . .	8 66	14 25	2 42	28 57	42 17

Although poultry does not eat ordinary beans readily, the writer has fed cracked teparies to a flock of hens with very satisfactory results. They seem to prefer other grain, but will also take daily a small quantity of the teparies. It is suggested therefore that this crop may be used as a source of protein in balancing the ration of poultry fed on milo maize or kafu corn in dry-farming sections.

*The Tepary as a human food:* The chief value of the tepary lies in its use as a human food. There is considerable difference of opinion as to the relative palatability of beans and teparies. Among the Indians and Mexicans, the pink bean is preferred to the tepary as they say it has a better flavor. These people, however, make the same difference between the pink bean and the white navy which is shipped in from the east. Teparies should be soaked twelve hours before cooking during which time they swell to at least twice their original volume and more than double in weight. In this respect they markedly surpass other beans. Well cooked teparies are light and mealy and have a rich bean-like aroma. Boiled and baked with bacon or mashed and added to soups they form most acceptable dishes. The following analyses by C. N. Catlin compare the nutritive elements in beans and teparies.

FOOD ANALYSES OF BEANS AND TEPARIES

	Water	In water-free substance <sup>a</sup>					Sp gr.
		Ash	Crude protein	Ether extract	Crude fiber	Carbohydrates	
Beans . . . .	9 56	4 81	27 21	1 23	4 67	62 09	1 22
Teparies . .	9 50	4 65	24 51	1 58	3 71	65 55	1 33

*Yields and culture:* The superiority of the tepary over other beans for planting in the Southwest is exhibited in its greater productivity when grown under similar conditions. This statement is not only true in irrigated sections, but even more marked in regions devoted to dry-farming. In nine experiments in Arizona covering almost every condition of soil, culture and water supply and extending over three years, the average yield of the teparies has been slightly more than four times the average for varieties of the kidney bean. The details of these comparative tests are shown in the following table. The experiments at Tucson were under the personal supervision of the writer. The data from the experiments at Yuma were furnished by Director R. H. Forbes, while those from McNeal were taken from the statements by Prof. R. W. Clothier in the Twenty-first Annual Report of this Station (See pages 368-369).

COMPARATIVE YIELDS OF BEANS AND TEPARIES

Locality	Year	Kind of farming	Pink beans lbs. per A.	Teparies lbs. per A.
Yuma	1909	Spring irrigation	233	1750
"	1909	Fall "	240	2050
"	1910	Spring "	138	2370
"	1910	Fall "	1060	1220
Tucson	1910	"	123	624
"	1911	"	166	741
McNeal	1910	Dry farming, light soil	76	264
"	1910	" heavy soil	107	256
"	1910	" supplemented by 4 in. deep of irrigating water	159	732

These greater yields are due to the ability of the tepary to germinate quickly in the presence of a low moisture content of the soil; hence the better stands of this crop on dry lands. The tepary is also able to withstand protracted seasons of drouth without permanent injury, returning to full vigor immediately when the rains come. Beans do not possess this ability to a marked degree. The tepary is also inured to the greatest extremes of our summer temperatures and will bloom and set seed during any month from May to November. On the other hand, when the blooming period of beans happens to fall within a season of extreme heat, the buds will for the most part drop

without setting pods. For these reasons the tepary is a more sure and dependable crop, often giving fair returns when beans are a total failure. With an ample supply of water, good soil and other conditions favorable, teparies should yield from 700 to 1200 pounds per acre. However, 500 pounds per acre have been reported from the Colorado Valley near Yuma. Under dry-farming conditions yields of 450 to 700 pounds have been reported and would with economical farmmanagement be profitable since at  $3\frac{1}{2}$ ¢ a pound this would bring a gross income of  $\$1.575$  to  $\$21.50$  per acre.

On irrigated lands teparies may be planted in southern Arizona any time from the early spring when danger of frost is past until August 10. The best crops, however, are secured by early planting, March 20 to April 1, or by mid-summer planting, July 12 to 25. In dry-farming, plant any time from the 10th to the 15th of July.

In the preparation of land for teparies care should be taken to have it as nearly level as possible and with a uniform slope. Low places in which water collects, or unevenness in the grade, will cause uneven ripening and consequent loss from shattering on the one hand, or from harvesting unripe plants on the other. The seed bed should be level and prepared to a depth of eight to ten inches. Do not plant until there is sufficient moisture in the soil to bring the seed up. The rows should be about three feet apart and the planter set to put the seed down to moisture even if it is necessary to go five or six inches deep. Where planted deep do not allow a crust to form above the seed before they come up. Prevent this by frequent and vigorous use of the harrow. The discs of the planter should be set to drop two or three seeds about every twelve inches. This will require about 12 pounds of seeds per acre. When planted by hand, open the furrow, drop the seeds and cover them before the soil dries out in the least. Negligence in this often makes the difference between success and failure in securing a stand. Where the furrows were allowed to dry out for three hours before the seeds were dropped and covered, a difference of five days was made in the time required to secure a stand when compared with rows which, on the same day and in the same field, were opened and the seeds dropped and covered immediately. After the stand is up irrigation and tillage should be made at intervals of seven to ten days until the vines interfere with the culture. Where the head of water is small, the most economical method of irrigation is the furrow system, but where the head is sufficient the rows may be flooded in the same manner as in the irrigation of corn. After each irrigation the surface should be lightly cultivated to prevent baking and excessive surface evaporation. The same principles of cultivation apply alike in dry and irrigation

farming. When, however, one is dependent upon the summer rains or flood waters for a crop it is especially necessary to follow each shower or flood of water with harrow or cultivator in order to provide a surface mulch for moisture conservation and also for the destruction of weeds which are themselves robbers of moisture and plant food. Harvesting and threshing are carried out in the same manner as for other beans. A bean huller is much to be preferred to threshing by flail or by the use of a grain separator, as it gives cleaner seed with a smaller percentage broken.

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