

PRELIMINARY STUDIES IN HORSE-GRAM

(*Dolichos biflorus* ; L.)

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Horsegram is a tropical pulse that derives its name from being primarily the gram that is fed to horses. It is the cheapest of pulses and is hence the poor man's pulse. It is the legume for poor soils and is often grown as the first crop on lands freshly reclaimed.

Name. The Sanskrit name of this pulse is *Kulattha* and many of the North Indian names are but modified expressions of this word. In Madras its vernacular names are, *Kollu* (Tamil) *Ulava* (Telugu), and *Hurali* (Canarese)

Acreage. An extensive rainfed crop, it occupies an area of over $1\frac{3}{4}$ million acres, distributed throughout the Madras Presidency. Anantapur, Coimbatore and Salem have over 200 thousand acres each; Bellary and Madura have each over 100 thousand acres; Malabar and Tanjore are the only two districts with less than 10 thousand acres.

Yield. In poor soils the yield of seed varies from 200 to 400 lb. 500 lb may be considered an average. Good yields run up to 800 lb of seed and 2000 lb of *Bhusa* (hay and chaff).

Characteristics and uses. The horsegram is a hardy plant, and thrives in areas of low rainfall and requires little or no manuring. Its cultivation is very easy, practically no care being required after sowing. Its long duration is an advantage in that its low, bushy, and matted growth serves to keep down weeds. It is an excellent green manure. When cut for fodder the roots remaining in the soil enrich it (Benson, 1879). Even when harvested for seed, the shed leaves enrich the soil and the *Bhusa* serves as an excellent fodder. It has the capacity to adapt itself to varying depths of sowing without serious impediments to germination and stand (Benson, 1885). It requires a good deal of lime in the soil to ripen the seed (Benson, 1879). The ash of the seeds contains a large quantity of phosphoric acid and the long continued use of the seeds is regarded as injurious (Church, 1886). In red soils horsegram follows *cholam* or *cambu* or a cereal in one year or the pulse and the cereal may be sown in alternate years if only one crop is raised in a year.

Description. This legume is a low, downy, herbaceous annual with profuse branching. It consists of a central main stem from which about 6 or 7 branches arise. Each main branch produces 3 to 9 secondary branches, which arise from the first node to the 9th, all along the branch. The length of the main branches varies from 45 to

105 cm. and the side branches vary from 15 to 75 cm. The ends of branches, after a period of about two months after sowing, lengthen out and begin to trail and intertwine among the plants and this gives the mat-like appearance to a well grown horsegram field. The leaves are trifoliate. The leaflets are oblong, pointed and are attached to the petiole by short thickened stalks. The central leaflet is slightly bigger than the lateral ones.

The flowers are in axillary clusters of two to four, two being the most common, and are chiefly borne on the secondary branches arising from the main branches. They arise from the first to the seventh axil of the branch, the rest of the branch not bearing any flowers. The flowers being produced at the basal portions of the branches, they are hidden under the mass of foliage. In a field of horsegram the flowers are, therefore, not conspicuous. The period of the differentiation of the stems into trailing branches connotes the beginning of flower production in the plant. The flowers are papilionaceous and are yellow. The standard has a prominent purple eye in the middle of the inside. The stamens are ten in number and are diadelphous. This diadelphous nature which usually escapes notice is traceable easily after the dehiscence of the anthers. The stamens are of two lengths, five of each kind. The anthers are oblong and yellow in colour. The style is long and slightly bent at the tip below the stigma. The stigma is green and is encircled by colourless hairs.

The pod is $1\frac{1}{2}$ to 2 inches long, recurved, rather flat, falcate and 5 to 6 seeded. The seeds are kidney shaped and are generally a mixture of chocolate and brown of shades. There are also minor varieties with black, black-mottled, and black-patchy seeds.

The study of this crop commenced in the year 1930 and the observations made during the three years are recorded.

Time of sowing. This is usually a cold weather crop and stays in the field after the cereals are harvested. Being long in duration, the time to sow at Coimbatore is from September to November. To suit a shorter duration certain black-seeded varieties are preferred in parts of the Presidency.

To determine the effect of sowing at various parts of the year, sowings were made at the beginning of each month from January 1933. Two lines, each a chain long, were sown in beds. The January, February, March and April sowings gave crops very leafy with late stray flowering and practically no setting of pods. Seed could be gathered from the crops sown from May to December. The May crop could be gathered early in March next. The duration of the May crop was 230 days and gradually decreased until that of the December crop was only 95 days. This reduction in duration was brought about conjointly in the dual periods up to first flowering and from flowering to

harvest. The longer duration and the earlier sowings conduced to keep up the gross out-turn of plant material as compared with the December sowings, but the optimum sowing time could be gauged from the following figures, which represent the ratios between gross yield and seed yield:— May 25, June 13, July 11, August 9, September 4, October 3, November 4, and December 29. From these figures it will be obvious that September to November is the best time to get the best out of the crop. Beyond this zone, the plant tends to be leafy and is fit only for fodder or green manure. This experiment serves to throw some light on environmental factors and their inter-relationship to the vegetative and reproductive phases of dry crops—a study so very essential to an intelligent pursuit of the problem of seed treatment as applied to dry crops in the tropics.

Leaf movements. The leaflets of horsegram make certain daily movements in response to temperature and light. In the morning (from 6 to 8 a. m.) the three leaflets are well spread out. From 8 a. m. onwards the central leaflet gradually moves upwards till it is erect and then droops down exposing its rear, while the two lateral leaflets gradually fall down and with increasing heat tend to curl so that their conjoint vertical disposition helps their surfaces to avoid the direct rays of the sun. This position is maintained till about 5 p. m. in the evening. At this period the central leaflet regains vigour, makes a retrograde movement and bends down backwards. The two lateral leaflets also untwist themselves. As darkness increases the leaflets bend further down and are almost massed together and assume a very compact and drooping appearance. This disposition of the leaflets gives the plants the conical look they assume at nightfall. This resting position is maintained throughout the night. The next morning the leaflets unfold again and continue their daily movements. This adaptability on the part of the leaves helps not a little to fit the gram as the most suitable one for dry-farming conditions.

Floral observations. The flowers of the horsegram are in axillary fascicles. The floral parts are of the usual papilionaceous type. The dehiscence of anthers takes place in the evening from 4 p. m. onwards. The bud at this stage is still unopened and the back of the standard still green. Anther-dehiscence is by longitudinal sutures. The pollen grains are massed together, not free and powdery as in *Dolichos lablab*. The grains do not shed, but as the stigma (at the time of anther-dehiscence) is on a level with the anthers and among them, it gets fully covered over with this massed pollen. This massed pollen is evidently a device for securing the pollination under the enclosed and sheltered condition in which this gram is fertilised. The individual pollen grains are very big. The standard opens out during the night, and continues to be so for nearly 24 hours. It then slightly fades and folds in as in the bud position, so much so, it is sometimes difficult to distinguish

this from the unopened bud. The young pod grows and pushes out through the dry petals.

The flowers are small and their pollination is so delicate that their crossing presents considerable practical difficulty. Many endeavours were made with little success. Being pollinated while still the flowers are closed, and sheltered as the flowers are by the leafy mass of the plant, any disturbance for artificial pollination results in the dropping of the treated flowers.

Purple pigmentation. As in almost all crops horsegram shows a variation in the manifestation of purple pigmentation. Unlike many other crops, this shows only two types of purple pigment named P_1 & P_2 . So far, no case has been met with where purple was completely absent in the plant, there being a purple eye in all flowers. P_1 is recognised by the presence of purple in the hypocotyle, internodes, petioles, stipels, a purple eye on the standard, and a light purple wash on the wings, keels and the style, when fresh. The developed pods are splashed with purple. In the P_2 , the purple is absent in the vegetative parts though the flower colour is the same as in P_1 . The difference between them lies only in the presence or absence of purple in the vegetative parts. From two families D. B. 14 and D. B. 27, which are of the P_2 type, three P_1 type natural crosses were spotted in 1931. The second generation raised in 1932 behaved as follows:—

Family.	D. B. No.	Segregation in F_2	
		P_1	P_2
D. B. 14 family	75	230	84
Do. Do	76	285	95
D. B. 27 Do.	78	114	48
		Total 629	227

A single factor is thus responsible for the difference between P_1 & P_2 .

Pods. Pods are commonly found sticking upwards from the axil of the leaf. In a few families pods have been observed to droop downwards from the leaf axil. This type of drooping pods is commonly noted in the varieties coming from Northern Circars. Similar erect and drooping pods have been met with in the field bean (*Dolichos lablab*).

Seed colours. The most common colour of horsegram seed is brown. This seed is admixed with a few chocolate coloured seeds. These two colours are produced in the same plant and also in all positions in the same pod. In the soaked condition this mixture of tints cannot be differentiated. In the year 1932 there were unusually heavy rains in November when the pods were developing. It is remarkable that from this crop the seeds were all brown and there were no chocolate coloured seeds excepting those that were insect attacked, badly set or otherwise deficient. In 1931 chocolate and brown seeds were

sown separately. At harvest time it was noticed that in both of them there were both kinds of seeds. This difference in colour is thus traceable to differential environment during the ripening of seeds.

The rarer seed-coat colours are (1) black, (2) black-mottled, and (3) black-patchy. The black-mottled seed consists of both chocolate and brown seed coats dotted over with black dots. In the case of the black-patchy, the seed has black patches on the seed coat, the black-free regions being mostly along the rim of the seed. The black seed is completely black. Crops from black coloured seeds have a tendency to be shorter in duration and a little less vigorous than crops raised from the more common brown seeds. In the varieties examined, it is noticeable, that black seeds, entire or mottled, appeared only on P₁ plants.

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THE PRESENT POSITION OF THE COTTON STEM WEEVIL PROBLEM *

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Introduction. *Pempheres affinis* or the cotton stem weevil, as a pest of indigenous and exotic cottons is of considerable importance in South India. It is not definitely known when and how this pest was introduced into this country; in fact it is even difficult to say whether it is one of the introduced forms at all; although the nature of its scattered and somewhat isolated distribution would appear to indicate its exotic origin.

When first noticed in South India it was found to be confined to the Coimbatore district and to the Cambodias in particular. Since then, it has spread to almost every cotton-growing centre of the Presidency and to all types of cotton.

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