

**CULTIVATION OF TWO VARIETIES OF WINGED BEAN  
(*Psophocarpus tetragonolobus*, L. DC) IN JABOTICABAL,  
SÃO PAULO**

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**SUMMARY**

Winged bean was recently introduced in the region of Jaboticabal, and the behavior of varieties "UPS-31" and "UPS-122" in different planting seasons was studied. Plantings were spaced 15 days, and the experiment started October 16, 1978 and ended December 15 of the same year. Plantings were made in rows, spaced 1.50 m from each other, leaving a distance of 0.60 m between plants. Their growth was tutored by bamboo poles which led them to a single wire placed horizontally at 1.70 m from the soil.

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Manuscrito modificado recibido: 2-3-83.

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An effect of the planting season was observed on flowering and fructification, since late plantings presented lower values for these characteristics and also decreased the harvesting period of the dry pods. Early plantings led to a higher development of the plants, and also to higher yield values as yield is a consequence of the number of pods per plant, with a high content of seeds per pod. Variety "UPS-122" was somewhat late in flowering and more vigorous than "UPS-31". The planting season did not affect the protein and oil contents, and average values in seeds of 43% and 17% were obtained, respectively.

### INTRODUCTION

The search for potential food sources, especially among species of the *Leguminosae* family, has been a continuous worry for several international agencies. Winged bean (*Psophocarpus tetragonolobus* (L.) DC) has been in evidence because of the high protein (29.8 – 37.4%) and oil (15.0 – 20.4%) contents of the seed; from this species, flowers, leaves, tuber roots, green pods and seeds are consumed (1).

Winged bean is a climbing and herbaceous perennial plant that can reach a height of 3 – 4 m if well supported. In the Asian tropics it is grown on terrains at sea level up to 2000 m, located between 20°N and 10°S latitude. Its cultivation, however, is more restricted to the tropical humid regions (1).

Apparently it requires short days for induction of normal flowering, and when grown outside the tropics it rarely flowers. This seems to be caused by day length differences and not by temperature. Generally, where grown, plantings are made at the beginning of the rainy season (1).

Winged bean presents self-pollinated perfect flowers, which vary in color from white to blue and purple. When planted in the lowland tropics inflorescence begins on the 50th day or after 3 to 4 months at higher altitudes. Pods are four sided, with their characteristic wings which vary in length from 6 to 36 cm, and contain 5 to 20 globular seeds each; seed color can be white, yellow, brown, black or mottled. Generally, it takes around 64 days for a pod to reach maturity and be ready for harvest (1).

There is a need for precise information concerning its cultivation, and also for establishing production practices in places where it has been introduced. The present experiment was carried out to study the behavior of this species in the environmental condi-

tions of Jaboticabal, São Paulo, on different planting dates, and their effects over the biological, morphological, agronomic and nutritional characteristics of two varieties.

#### MATERIAL AND METHODS

The two varieties of winged bean studied, "UPS-122" and "UPS-31", both with dark purple seeds, were introduced from Papua New Guinea, and submitted to a planting season experiment in Jaboticabal, São Paulo (21°15'02"S; 48°15'18"W; 610 m). Planting was spaced 15 days, starting in October 16, 1978 and ending in December 15, 1978.

Varieties were sown in rows at a distance of 1.50 m and 0.60 between plants in a 2 x 5 factorial design, with 17 plants per parcel. Each plant hole received 11 g of a 4-31-6 fertilizer formulation. Bamboo poles were used as tutors for the plants, and they were supported by a single wire at 1.70 m from the soil.

For each planting date, data were collected on different development phases of the plant. For germination, inflorescence differentiation, flower opening and dry-pod harvest, observations were made in all plants of each parcel. Pod growth was measured daily in four plants per parcel. Data on plant length, yield components and seed yield per plant were determined in eight plants per parcel, assuming each plant as a replicate for statistical analysis.

All periods of time are expressed in days as units, followed by decimal fractions.

Analyses of protein and oil were performed in triplicate according to the AOAC methodology (2).

#### RESULTS AND DISCUSSION

Data for germination, inflorescence and pod harvest are presented in Table 1. As observed, seeds of variety "UPS-122" took longer to germinate than those of "UPS-31"; this difficulty for germination could be explained by a water absorption problem. With respect to flowering and pod harvest, an effect of the planting dates over these two characteristics is also evident. Early planting dates induced a longer time for the flowering of the plants; pod harvest was more concentrated in time in the later planting dates. Variety "UPS-122" is later than "UPS-31".

TABLE 1

DATA ON GERMINATION, INFLORESCENCE AND DRY-POD HARVEST FOR TWO WINGED BEAN VARIETIES ON SEVERAL PLANTING DATES

(Expressed as days after planting)

Planting dates	Germination		Floral bud differentiation		First flower opening		First dry-pod harvest		Last pod harvest	
	UPS-31	UPS-122	UPS-31	UPS-122	UPS-31	UPS-122	UPS-31	UPS-122	UPS-31	UPS-122
October 10	10.13	21.83	70.00	84.50	88.45	102.25	152.25	170.05	183.50	194.76
October 31	9.25	27.50	61.50	83.60	80.33	110.30	143.75	167.00	172.00	181.00
November 15	10.58	18.12	68.83	84.56	88.58	99.87	139.88	154.13	160.70	166.00
November 30	8.58	15.92	56.50	77.15	74.50	94.76	138.75	145.25	145.88	159.88
December 15	7.31	17.69	63.61	78.83	81.00	93.91	127.88	137.00	139.88	154.00

The former variety presented longer pods (25.26 cm) and a higher daily pod growth rate (1.22 cm) than "UPS-31", that presented values of 10.94 cm and 0.65 cm, respectively (Table 2). Both varieties presented almost similar periods for each phase of plant flowering and fructification, taking around 16 days for a pod to reach final growth and 41 days for it to be dry and ready for harvest. These values are in accordance with those presented in the literature (1), and were not influenced by planting dates.

A marked effect of planting dates on yield components and seed yield was observed (Table 3). First plantings induced bigger plant developments and higher seed yields per plant. Yield was a consequence of the number of pods per plant and seeds per pod. According to these data, "UPS-122" is more vigorous and productive than "UPS-31" (3).

Table 3 also shows that plant vigor in both varieties was impaired by late planting, and this had a significant influence on the dry matter production. This impairment in plant vigor, however, did not affect seed yield in variety "UPS-31", but in "UPS-122" it did induce losses of 720/o.

In regard to seed protein and seed oil contents, planting dates did not have any effect on them, as it occurs in other crops, soybeans, for example, where this factor plays an important role on these components (4). Protein contents obtained from the different parts of the plant are very high (Table 4), justifying their consumption by certain population groups.

Seed protein content is higher in "UPS-122" than in "UPS-31". Seed oil content is within the range notified by the literature (1) and no differences were detected between these two varieties. Seed composition resembles that of wild or non cultivated soybeans, which have a high protein and low oil content (5). These values are also high, when compared with data obtained from four "Tpt" varieties introduced from Venezuela, which presented a seed protein content of 39.56 – 41.770/o and an oil content of 12.23 – 13.710/o (6).

According to these results, it can be stated that the newly introduced material has a good adaptation to local environmental conditions, with a certain effect of photoperiod, expressed by the planting dates. It also shows a good potentiality for protein and oil production that, associated to yield, can become a good food source. Because of the planting system required by this species, it can be better utilized as a source of green pods, since large scale production of seeds would be made difficult by plant tutoring and by the irregular pod maturity.

TABLE 2

DATA OF FLOWERING, FRUCTIFICATION, AND POD GROWTH, OBTAINED IN INDIVIDUAL FLOWERS AND PODS OF TWO WINGED BEAN VARIETIES

Variety	Phases					Total number of days	Daily pod growth rate (cm)	Total pod length (cm)
	1st	2nd	3rd	4th	5th			
UPS-31	14.82	3.60	3.70	14.50	42.35	78.97	0.65 ± 0.42*	10.94 ± 0.96*
UPS-122	16.38	3.53	3.62	17.65	40.20	81.38	1.22 ± 0.58	25.26 ± 2.66

Phase 1: Appearance of floral bud to petal showing.

Phase 2: Petal showing to flower opening.

Phase 3: Flower opening to beginning of ovary development.

Phase 4: Beginning of ovary development to final pod growth.

Phase 5: Final pod growth to complete pod dryness.

\* Mean ± standard deviation.

TABLE 3

PLANT CHARACTERISTICS OF TWO WINGED BEAN VARIETIES OBSERVED ON DIFFERENT  
PLANTING DATES, JABOTICABAL, SÃO PAULO

Planting dates	Stem diameter (mm)		Plant length (m)		No. pods/plant		No. seeds/pod		Dry matter weight**		Yield/plant (g)	
	UPS-31	UPS-122	UPS-31	UPS-122	UPS-31	UPS-122	UPS-31	UPS-122	UPS-31	UPS-122	UPS-31	UPS-122
Oct./10	9.89 <sup>a*</sup>	15.39 <sup>a</sup>	3.66 <sup>a</sup>	4.17 <sup>a</sup>	43.62 <sup>a</sup>	38.25 <sup>a</sup>	7.28 <sup>a</sup>	12.91 <sup>a</sup>	95.89	156.96	75.55 <sup>a</sup>	153.79 <sup>ab</sup>
Oct./31	10.48 <sup>a</sup>	12.31 <sup>b</sup>	3.45 <sup>ab</sup>	4.11 <sup>a</sup>	38.12 <sup>a</sup>	28.75 <sup>ab</sup>	7.44 <sup>a</sup>	11.65 <sup>ab</sup>	94.36	109.18	61.00 <sup>a</sup>	104.71 <sup>b</sup>
Nov./15	9.81 <sup>a</sup>	11.51 <sup>bc</sup>	3.47 <sup>ab</sup>	4.10 <sup>a</sup>	49.00 <sup>a</sup>	23.25 <sup>ab</sup>	6.96 <sup>a</sup>	11.05 <sup>ab</sup>	66.62	86.61	67.86 <sup>a</sup>	82.30 <sup>b</sup>
Nov./30	7.28 <sup>b</sup>	9.72 <sup>cd</sup>	3.39 <sup>ab</sup>	3.15 <sup>b</sup>	37.62 <sup>ab</sup>	24.75 <sup>ab</sup>	7.60 <sup>a</sup>	10.78 <sup>b</sup>	37.56	52.71	48.84 <sup>a</sup>	71.29 <sup>bc</sup>
Dec./15	5.45 <sup>b</sup>	8.55 <sup>d</sup>	3.15 <sup>b</sup>	3.22 <sup>b</sup>	22.88 <sup>b</sup>	20.38 <sup>b</sup>	8.24 <sup>a</sup>	10.44 <sup>b</sup>	12.82	41.36	37.14 <sup>a</sup>	42.86 <sup>c</sup>
$\Delta$ (5°/o)	2.14 mm		0.39 m		15.01		1.89		36.18 g		41.20 g	
CV. (°/o)	15.20		7.68		32.74		14.21		48.34		39.27	

\* Means in the same column identified by the same letter, are not statistically different.

\*\* Aerial part of the plant, without leaves or pods.

TABLE 4

AVERAGE VALUES FOR PROTEIN, OIL AND ASHES, FOUND IN SEVERAL PLANT PARTS  
OF TWO WINGED BEAN VARIETIES

Plant parts	Protein*		Oil*		Ashes*	
	UPS-31	UPS-122	UPS-31	UPS-122	UPS-31	UPS-122
Leaves	29.66	29.49	—	—	7.10	6.30
Flowers	31.18	36.12	—	—	6.58	7.18
Green pods	24.48	22.52	—	—	5.62	4.40
Seeds	41.30	45.11	17.46	17.08	4.40	4.71

\* g/100 g on a dry-weight basis.

**RESUMEN****CULTIVO DE DOS VARIEDADES DE FRIJOL ALADO  
(*Psophocarpus tetraganologus* (L.) DC) EN JABOTICABAL — SÃO PAULO**

El frijol alado fue recientemente introducido en Jaboticabal, São Paulo, para estudiar el comportamiento de las variedades "UPS-31" y "UPS-122" en distintas épocas de siembra. Esta fue efectuada a intervalos de 15 días, iniciándose el 16 de octubre de 1978 y terminándose el 15 de diciembre de 1978. La siembra se realizó en surcos con una separación de 1.50 m entre sí, y a una distancia entre plantas de 0.60 m. El crecimiento de las mismas fue dirigido por un soporte de bambú, hacia un alambre situado horizontalmente a una distancia de 1.70 m del suelo.

Se observó cierto efecto de época de siembra sobre la floración y fructificación, pues las plantaciones tardías presentaron valores inferiores en los parámetros mencionados, así como una reducción en el número de vainas que alcanzaron madurez.

La siembra temprana indujo un mejor desarrollo de las plantas, así como valores más altos en rendimiento, el cual deriva de un mayor número de vainas por planta con un contenido más elevado de semillas. La variedad "UPS-122" fue más tardía y vigorosa que la "UPS-31". La época de siembra no influyó en el contenido de proteína y aceite, obteniéndose valores promedios en las semillas de 43% y 17%, respectivamente.

**ACKNOWLEDGEMENTS**

The authors wish to express their gratitude to Dr. Russ Stephenson of Papua New Guinea University, for supplying seeds of the cultivars used in the present study.

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