Southernpea Cultigens Differ in Ease of Pod Detachment

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Abstract. A force gauge was used to measure the force required to detach pods from plants of 16 southernpea [*Vigna unguiculata* (L.) Walp.] cultigens. Pod detachment force (PDF) measurements ranged from 21.4 N for MN-13 to 11.8 N for 'Royal Cream'. Pod length, diameter, and weight; basal pod vacancy (inverse of fill); and peduncle synapse length were recorded for each pod sampled for detachment force. There was no strong association between PDF and any of the five traits.

Several southernpea cultivars can be mechanically harvested with a commercial green-bean harvester when they are at the mature-green stage. Ease of pod detachment may be an important consideration when selecting cultivars for mechanical harvest. Variation for ease of fruit detachment exists in other crops (Burnham and Peterson, 1970b; Setiamihardja and Knavel, 1980; Villalon and Byran, 1970; Werner and Honma, 1980). In pepper (*Capsicum annuum* L.), fruit detachment force is genetically controlled and positively correlated with fruit length, width, and weight and with pedicel length and diameter (Setiamihardja and Knavel, 1990; Werner and Honma, 1980). Burnham and Peterson (1970b) reported that fruit detachment force in cucumber (*Cucumis sativus* L.) is more highly correlated with fruit length than with fruit weight or diameter, and it is related to stem-scar diameter in tomato (*Lycopersicon esculentum* Mill.) (Villalon and Byran, 1970) and stem attachment area in cucumber (Burnham and Peterson, 1970a).

Our objectives were to determine whether variation for pod detachment force (PDF) exists among southernpea cultivars and breeding lines and to determine whether an association exists between PDF and pod weight, length, and diameter; basal pod fill; and peduncle synapse length. Knowledge of PDF variation and association of morphological traits with PDF would be helpful to a breeding program developing cultivars for mechanical harvest at the mature-green stage.

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Materials and Methods

Sixteen southernpea cultigens were planted in a Ruston fine sandy loam at the Calhoun Research Station, Calhoun, La. The design was a randomized complete block with four replications. Plant spacing within a plot was 8 to 10 cm. Plots were 3 m long on rows 102 cm

apart. Five plants from each plot were sampled at random. Detachment force readings were taken for three random mature-green pods on each selected plant with a force gauge (John Chatillon and Sons, Kew Gardens, N.Y.). A hole was drilled in one end of a small C-clamp, and an eye bolt was attached. The clamp was fastened firmly to the peduncle just next to the point of pod attachment. A hook attachment was threaded onto the force gauge and the force gauge was attached to the eye bolt with the hook. PDF was determined by slowly pulling the peduncle perpendicular to the longitudinal pod axis until the pod and peduncle separated (Fig. 1). Force was recorded in kilograms and then converted to Newtons. The weight, length, and diameter of each pod were measured. Diameter was measured at the mid-section of a seed, perpendicular to the suture. The basal ends of some pods were empty due to the absence of developed seeds. The vacant portion of the pod was designated "basal pod vacancy" (BPV) (the inverse of pod fill), and its length was measured. The length of peduncle, where synapse occurs, was measured just before a detachment force reading.

Analysis of variance was performed on PDF data, and means were separated by Duncan's multiple range test. Stepwise regression was conducted to determine relationships among the morphological traits and PDF.

Fig. 1. Detachment of a southernpea pod with a force gauge.

Table 1. Pod detachment force (PDF), pod weight (PWT), pod length (PL), pod diameter (PD), basal pod vacancy (BPV), and peduncle synapse length (PS) for 16 southernpea cultigens.

Cultigen	PDF (N)	PWT (g)	PL (cm)	PD (mm)	BPV (mm)	PS (mm)
MN-13	21.4 a ²	5.1 hi	17.1 c-e	6.5 g	7.3 ef	4.0 a
L 90-8	19.5 ab	7.9 b	20.8 a	8.8 b	18.7 a	3.4 b
Mississippi Silver	18.3 bc	8.8 a	16.5 ef	9.2 a	6.6 ef	2.6 d
L 90-10	17.4 b-d	7.0 c	15.0 gh	9.4 a	11.5 cd	3.0 c
AR 84-154	17.4 b-d	5.4 gh	17.1 c-e	6.7 fg	6.2 f	3.1 c
Texas Pinkeye	17.0 b-d	6.2 d-f	17.4 cd	5.4 i	9.3 de	3.9 a
Better Green	16.4 cd	6.0 e-g	14.8 h	7.6 cd	7.6 ef	1.6 f
Royal Pinkeye	15.8 cd	6.5 c-e	15.7 fg	7.3 de	9.1 de	2.9 c
Encore	15.3 de	5.5 gh	12.5 i	8.7 b	7.4 ef	2.4 d
Mississippi Cream	15.3 de	6.6 cd	18.6 b	6.8 f	13.6 bc	3.9 a
L 90-17	15.1 de	6.6 cd	15.8 fg	8.7 b	15.9 b	3.1 c
Pinkeye Purplehull BVR	15.0 de	6.7 cd	16.7 de	7.8 c	11.3 cd	2.8 c
MN-150	14.7 de	4.3 j	17.7 c	6.2 h	5.5 f	4.0 a
L 90-22	12.8 ef	4.7 ij	13.0 i	7.4 de	10.7 d	2.1 e
Royal Cream Crowder	12.6 ef	5.8 fg	14.7 h	7.5 cd	7.0 ef	3.1 c
Royal Cream	11.8 f	5.9 e-g	16.3 ef	7.2 e	6.2 f	3.4 b

²Mean separation within columns by Duncan's multiple range test at $P \leq 0.05$.

Results and Discussion

Lower PDF measurements indicate ease of pod detachment. 'Royal Cream', 'Royal Cream Crowder', and L 90-22 had the lowest PDFs, although the latter two did not differ significantly from several others. The highest PDFs were recorded from MN-13 and L90-8, the latter differing little from five others. Stepwise regression analysis of the data for measured traits indicated no strong relationship between PDF and any of the traits measured. However, pod length and weight did fit the regression

model at $P \leq 0.15$. Means for the five traits are presented in Table 1.

Wide PDF variation was found among the 16 southernpea cultivars and breeding lines. This information can be used to examine the genetic control of PDF. Further studies are needed to examine morphological and physiological associations with PDF.

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