

ASSESSMENT OF JACK BEAN GENOTYPES FOR SEED CHARACTERS AND NUTRITIONAL QUALITY

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ABSTRACT

Ever increasing population especially in developing countries like India require alternate available sources of energy and nutrition. Production of traditional leguminous crops in these countries has not adequately met the energy and nutritional requirements of growing population. Exploitation of wild or under exploited legumes is necessary to combat Protein-Energy-Malnutrition (PEM). Hence, this study has been under taken to assess the available genotypes of Jack bean an underexploited vegetable crop for their nutritional quality at NBPGR Regional station, Rajendranagar during Kharif 2013 (August 2013 to February 2014). The results revealed that significant differences were observed among the genotypes for all the nutritional characters studied. Out of fifteen genotypes, PSR 12202 was found superior in terms of protein (20.80%), magnesium (0.36%), calcium (0.75%), sodium (0.07%) and potassium (4.22%) content followed by NS/2009/053 for protein (20.7%) and phosphorus (0.29%) content while, the genotype IC-32881 was recorded highest iron (100.80 mg kg⁻¹) content. Among the genotypes studied NS/2009/053 and RJR- 529 were superior in terms of seed length, seed breadth, seed thickness and 100 seed weight. Hence, these superior genotypes may be further tested in multi location trials and can be recommended for commercial cultivation to meet the nutritional requirement.

Keywords: Jack bean, underexploited vegetable, nutritional quality

INTRODUCTION

Jack bean (*Canavalia ensiformis* (L.) DC.) belongs to the family leguminaceae. The Genus *Canavalia* consisting of 48 species of which, four species are reported from India, viz., *C. ensiformis*, *C. gladiata*, *C. maritima* and *C. virosa*. Out of these four species, *C. ensiformis* (Jack bean) and *C. gladiata* (Sword bean) were reported in North East region of India and are being cultivated for the edible pods (Bose *et al.* 2003). The foliage and the seeds of Jack bean contain growth inhibiting protein substances (canavalin, concanavalin A, concanavalin B), amino acid (canavanine) and toxins (choline, HCN and trigonelline). The concentration of these substances increases with age and maturity of plant tissue. Hence, only tender foliage and pods are edible. The dried seed is consumed only after prolonged cooking (Bose *et al.* 2003). Pulses meet only about 20% of protein requirement facing the scarcity of protein and so the exploitation of wild legumes is necessary to combat Protein-Energy-Malnutrition (PEM), especially among children below the age of 5 years in India (Bhagya *et al.* 2009). Dada *et al.* (2013) reported 15.45-21.85% and Marimuthu and Gurumoorthi (2013) reported 24.32 ± 0.11 g/100 g protein content in *Canavalia ensiformis* seeds. Hence, the search for alternate wild legumes as a cost effective source of energy and nutrition is highly essential. The literature available on nutritional quality of pod and seed characters is very meager.

Therefore, this study was under taken to assess the available genotypes of Jack bean for their seed characters as well as pod nutritional quality.

MATERIALS AND METHODS

The present study was carried out at National Bureau of Plant Genetic Resources, Regional Station, Rajendranagar, Hyderabad in a randomized block design with three replications during August 2013 – February 2014. The seeds of fifteen genotypes were sown in rows with spacing of 3.0 ‘m’ between rows and 0.5 ‘m’ between plants. The climate of Hyderabad is semi arid tropical climate and it lies at latitude of 17.19° N and longitude of 79.23° E, with an altitude of 542.3m above the Mean Sea Level. All the package of practices to raise the crop was followed as recommended for dolichos bean as Jack bean is under exploited vegetable. The need based plant protection measures were taken to raise the healthy crop. Data were collected on randomly selected five plants in each genotype for seven parameters viz., protein, sodium, potassium, calcium, magnesium, iron and phosphorus content of pod and six characters of seed viz., number of seeds per pod, 100 seed weight, seed length, seed breadth and seed thickness. The mean data was subjected to statistical analysis as per the methods given by Panse and Sukhatme (1967). The protein content was estimated as per the method of Lowry *et al.* (1951). The phosphorus content in the diacid (HNO₃: HClO₄) digest was determined by vanadomolybdo phosphoric

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yellow colour method. The sodium and potassium content in diacid extract was determined using flame photometer Calcium, magnesium and iron in diacid digest were determined in Atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

The results (Table 1) revealed that protein content ranged from 16.6 to 20.8% with a mean of 18.36%. Among the genotypes, the highest protein content (20.8%) was recorded in PSR-12202 followed by NS/2009/053 (20.7%) and lowest in N/06-158 (16.6%). Dada *et al.* (2013) also reported 15.45-21.85% and Marimuthu and Gurumoorthi (2013) reported 24.32 ± 0.11 g/100 g protein content in *Canavalia ensiformis* seeds. The mean value for magnesium content was 0.20% with a range from 0.13 to 0.36%. The genotype, PSR-12202 recorded highest percentage of magnesium (0.36%) while the lowest (0.13%) was recorded in RJR-628, NSA/08/002, NSA-69 and NSKS-346. The highest value of Ca content (0.75%) was recorded in PSR-12202, and lowest in NSA/08/002 (0.21%) with a general mean of 0.33%. These results were similar to the findings of Ajeigbe *et al.* (2012) in *Canavalia ensiformis* seeds and 131.75 mg/kg calcium content was reported by Gabriel-Ajobiwe *et al.* (2012) in *Canavalia ensiformis* raw beans. Among the genotypes, iron content ranged from 37.60 (NS-

2009/059) to 100.80 mg kg⁻¹ (IC-32881) with a mean of 62.56 mg kg⁻¹. Akingbade *et al.* (2009) also reported 7.31% iron content in *Canavalia ensiformis* seeds and Bhagya *et al.* (2009) reported 1.39±0.09 mg/100 g iron content in *Canavalia maritima* ripe beans. The mean value of sodium content was 0.0463% with a range from 0.036 to 0.073%. The genotype PSR-12202 recorded the highest (0.073%) sodium content, while the lowest was recorded in IC-541380 (0.036%). Sodium content of 369.75 mg/kg in raw beans of *Canavalia ensiformis* was reported by Gabriel-Ajobiwe *et al.* (2012) and 1.75 mg/g was reported by Ajeigbe *et al.* (2012) in *Canavalia ensiformis* seeds. Potassium content ranged from 2.24 to 4.22% with a mean of 2.81%. The highest potassium content (4.22%) was recorded in PSR-12202, while the lowest (2.24%) was recorded in IC-512496 and RJR-628. Similar results were reported by Bhagya and Sridhar (2007) in tender pods of *Canavalia cathartica* and Seena *et al.* (2006) in seeds of *Canavalia cathartica*. Out of 15 genotypes evaluated, the highest phosphorus content (0.29%) was recorded in PSR-12202, NS/2009/053, NSB/2010/035 and RJR-529 and lowest (0.12%) in NSA-34. These results were similar to findings of Bhagya *et al.* (2009) in ripe beans of *Canavalia maritima* and Bhagya and Sridhar (2007) in tender pods of *Canavalia cathartica*.

Table 1: Estimates of protein and mineral contents in Jack bean

Genotypes	P (%)	Mg (%)	Cl (%)	Iron (mg kg ⁻¹)	S (%)	K (%)	Pb (%)
RJR- 628	18.70	0.13	0.26	59.60	0.042	2.24	0.26
NS-2009/059	17.50	0.15	0.29	37.60	0.040	2.64	0.24
IC-541380	20.00	0.25	0.36	69.80	0.036	2.34	0.28
IC-32881	19.30	0.32	0.36	100.80	0.058	3.36	0.08
IC-26174	16.80	0.14	0.27	78.40	0.044	3.24	0.27
NS/2009/053	20.70	0.26	0.37	68.40	0.052	3.26	0.29
NSB/2010/035	17.20	0.15	0.35	60.80	0.046	2.51	0.29
PSR 12202	20.80	0.36	0.75	71.60	0.073	4.22	0.29
NSA/08/002	18.40	0.13	0.21	70.80	0.042	3.02	0.26
IC-512946	16.80	0.31	0.22	63.80	0.056	2.24	0.23
NSA-69	18.20	0.13	0.26	56.80	0.038	2.67	0.27
RJR- 529	17.00	0.14	0.32	67.60	0.046	2.43	0.29
N/06-158	16.60	0.15	0.33	43.00	0.040	2.61	0.28
NSA-34	17.20	0.20	0.26	49.60	0.040	3.23	0.12
NSKS- 346	20.30	0.13	0.39	39.80	0.042	2.25	0.28
Mean	18.36	0.19	0.33	62.56	0.04	2.81	0.24
C.V.	3.20	11.50	14.00	3.28	9.25	10.86	16.80
S.E. m±	0.33	0.01	0.02	1.18	0.002	0.17	0.024
C.D (P=0.05)	0.98	0.03	0.07	3.44	0.007	0.51	0.07
CD (P=0.01)	1.32	0.05	0.10	4.64	0.009	0.69	0.09

Table 2: Performance of jack bean genotypes for seed characters

Genotypes	Number of seeds per pod	100 seed weight (g)	Seed length (mm)	Seed breadth (mm)	Seed thickness (mm)
RJR- 628	7.93	141.42	21.89	14.14	9.87
NS-2009/059	9.36	241.41	22.85	15.54	11.12
IC-541380	12.73	132.99	18.55	11.99	9.06
IC-32881	9.10	128.55	19.86	13.0	9.54
IC-26174	9.30	126.96	18.64	12.56	8.96
NS/2009/053	7.20	315.25	25.27	18.77	12.12
NSB/2010/035	11.33	132.73	18.68	12.93	8.36
PSR 12202	10.20	314.31	24.49	16.63	12.05
NSA/08/002	7.00	192.59	17.83	8.87	6.99
IC-512946	10.13	138.67	18.92	12.71	9.68
NSA-69	7.23	116.75	21.86	12.79	8.57
RJR- 529	12.23	302.34	25.48	17.96	12.77
N/06-158	7.06	147.38	19.22	13.19	9.97
NSA-34	8.53	134.11	18.96	12.52	9.76
NSKS- 346	11.46	153.36	19.61	12.71	9.59
Mean	9.38	181.25	20.81	13.75	9.89
C.V.	7.32	6.75	3.01	3.91	3.89
S.E. m±	0.39	7.06	0.36	0.31	0.22
C.D (P=0.05)	1.15	20.46	1.05	0.90	0.64
CD (P=0.01)	1.55	27.60	1.41	1.21	0.86

The seed characters of jack bean (Table 2) indicated that number of seeds per pod ranged from 7.00 to 12.73 with a mean of 9.38. Among the genotypes studied, the significantly superior genotype in terms of number of seeds per pod was IC-541380 as it recorded maximum number of seeds per pod (12.73) which was on par with RJR-529 (12.23) whereas minimum number of seeds per pod (7.00) was recorded in NSA/08/002. The maximum number of seeds per pod in IC-541380 may be due to more number of primary branches which had well developed vascular tissue connection along with the genetically fixed potential which was exploited for the formation of well filled pods as a result maximum number of seeds per pod. The mean for 100 seed weight was 181.25 g with a range from 116.75 g to 315.25 g. The genotype, NS/2009/053 recorded significantly maximum weight of 100 seeds (315.25 g) which was on par with PSR 12202 (314.31) and RJR-529 (302.34) whereas minimum weight of 100 seeds (116.75 g) was recorded by the genotype NSA-69. In French bean, Kulaz and Ciftci (2012) reported the range of 178.0 - 573.3 seeds per plant with a mean of 422.88 respectively and in Dolichos bean, the range of 18.01 to 59.26 and mean of 35.61 g was recorded by Upadhyay and Mehta (2010). The length of seed ranged from 17.83 mm to 25.48 mm with a general mean of 20.81 mm. Significantly maximum

seed length (25.48 mm) was observed in RJR-529 followed by NS/2009/053 (25.27) and PSR 12202 (24.49) while minimum (17.83 mm) was recorded in NSA/08/002. Bode *et al.* (2013) reported the range and mean value of seed length as 0.89 to 1.66 and 1.25 respectively in French bean. The genotype RJR-529 had the maximum leaf length and due to selective translocation of photosynthates, the seed length and thickness was increased rather than pod. This genotype may be considered good for seed purpose. Among the genotypes, seed breadth ranged from 8.87 mm to 18.77 mm with a mean of 13.75 mm. The genotype, NS/2009/053 recorded significantly maximum seed breadth (18.77 mm) which was on par with RJR-529 (17.96) while minimum seed breadth (8.87 mm) was recorded in NSA/08/002. Bode *et al.* (2013) reported the range and mean value of seed breadth as 0.31 to 0.59 and 0.41 respectively in French bean. The thickness of seed ranged from 6.99 mm to 12.77 mm with a general mean of 9.89 mm. The significantly superior genotype in terms of seed thickness was RJR-529 as it recorded maximum seed thickness (12.77 mm) whereas NSA/08/002 recorded minimum seed thickness (6.99 cm). In French bean, Bode *et al.* (2013) reported the range and mean value of seed thickness (cm) as 0.50 to 0.89 and 0.69 respectively.

From the results it can be concluded that the genotypes PSR 12202, IC-32881, NSB/2010/035, NS/2009/053 and RJR- 529 were found to be superior in terms of protein and minerals. Hence, these superior genotypes may be further tested in multi location trials and can be recommended for

commercial cultivation to meet the nutritional requirement. Among the genotypes studied NS/2009/053 and RJR- 529 were superior in terms of seed length, seed breadth, seed thickness and 100 seed weight.

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