

Observations on the development of selection criterion for high yield and low neurotoxin in grass pea based on genetic resources.

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Grass pea (*Lathyrus sativus* L.) is an ancient crop, it has been found in Indian archaeological remains as old as 2000-1500 BC⁽⁶⁾. *Lathyrus* species are found in the old and new worlds, there are centres of diversity for old world species in Asia Minor and the Mediterranean region⁽⁷⁾. In India grass pea is cultivated on more than 600 000 hectares in the state of Madhya Pradesh alone. Grass pea has many good qualities e.g. high protein, drought tolerance, suitability for relay cropping with paddy rice and resistance to pests of stored grain. However, the presence of the neurotoxin β -N-oxalyl-L- α,β -diaminopropionic acid (ODAP) in the grain can be problematic for human consumption as ODAP is known to cause the disease "lathyrism"⁽⁵⁾.

In the course of evolution, as well as in the crop improvement programmes, populations are constantly shifting towards superior types. The economic value of a plant can depend upon several characters. In grass pea, seed yield and low neurotoxin content, determine the value of the plant. No work has been done in the past on the aspect under study. To develop selection criteria for high yield and low ODAP content, separate correlation studies were undertaken on genotypes belonging to different distinct morphological groups for ODAP content and various yield traits.

For the purpose 270 accessions of grass pea (consisting of 222 indigenous primary collections, 41 secondary collections and 7 exotic accessions i.e. 2 Italian and 5 Canadian) were used. The experiment was conducted at Indira Gandhi Agricultural University, Raipur, Madhya Pradesh, India during winter season of 1997-98. The accessions were evaluated for the traits under study in augmented design with five checks viz. Pusa-24, LSD-3, RLS-1, RLK-1098 and Bio L-212. Each entry was sown in single row of 4m length placed at 30 cm apart. Standard agronomic practices were adopted to raise a normal crop.

Observations on various traits were recorded individually on five randomly tagged single plants for

each genotype, as per the descriptors decided by National Bureau of Plant Genetic Resources, New Delhi. Measurement of ODAP was done as per the method of Rao⁽⁴⁾ and further modified by Briggs⁽¹⁾. Analysis of data for augmented design was done according to Peterson⁽³⁾. Correlation coefficients can be used to assess the degree and direction of relationship between two or more variables. They provide better understanding of yield and quality trait selection⁽²⁾. Not all correlations are reported for the sake of brevity.

Correlations

Results of the study revealed that across all accessions (Table 1), days to flowering, days to maturity and pod length were negatively correlated with seed yield/plant. Pods/plant was positively correlated with seed yield/plant.

Table 1: Correlation coefficients among plant traits and ODAP content for all *Lathyrus sativus* accessions.

	Seed yield/ plant (g)	ODAP (%)
Days to flowering	-0.260	-0.013
Days to maturity	-0.334	-0.123*
Plant height (cm)	-0.107	-0.082
Branches/ plant	0.085	-0.065
Pods/ plant	0.158**	-0.077
Pod length (cm)	-0.157**	0.006
Seeds/ pod	0.059	-0.015
Seed yield/ plant (g)		-0.134*

* P<0.05; ** P<0.01

For erect plant types (Table 2) seed yield/plant was found to be negatively correlated with days to maturity and pod length. Pods/plant showed positive association with seed yield/plant and negatively with ODAP content. In spreading plant types days to flowering, maturity and pod length showed negative correlation with seed yield/plant.

In green plant types (Table 3) days to flowering and days to maturity were negatively correlated with seed yield/plant and ODAP content. In pigmented plant types days to flowering and maturity showed negative correlation with seed yield/plant. Pods/plant showed positive association with seed yield/plant in the same group.

In narrow leaf type group (Table 4) seed yield/plant was positively correlated with branches/plant, pods/plant and seeds/pod. Conversely, seed yield/plant had negative correlations with days to flowering and maturity. Hence, selection of narrow leaf plants for early maturity, increased branching, seeds/pod and pods/plant could lead to the development of plants possessing higher seed yield/plant. Similarly, direct

selection for high seed yield/plant could lead to the development of low ODAP content.

Table 2. Correlation coefficients among ODAP content and plant traits in plant habit groups of *Lathyrus sativus* accessions.

		Seed yield/ plant (g)	ODAP (%)
Days to flowering	E	-0.031	0.106
	S	-0.222*	-0.033
Days to maturity	E	-0.237**	-0.900
	S	-0.196	-0.146
Plant height (cm)	E	-0.064	-0.145
	S	-0.058	0.043
Branches/ plant	E	0.105	-0.136
	S	-0.054	0.029
Pods/ plant	E	0.235**	-0.203**
	S	0.115	-0.099
Pod length (cm)	E	-0.190	0.131
	S	-0.217*	-0.108
Seeds/ pod	E	0.070	0.025
	S	0.035	-0.124
Seed yield/plant (g)	E		-0.165*
	S		-0.039

* P<0.05; ** P<0.01; E- Erect plant type group; S- Spreading plant type group

Table 3. Correlation coefficients among neurotoxin content and plant traits in plant colour group of *Lathyrus sativus* accessions.

		Seed yield/ plant (g)	ODAP (%)
Days to flowering	G	-0.344**	-0.314**
	P	-0.159*	0.105
Days to maturity	G	-0.458**	-0.330**
	P	-0.257**	0.023
Plant height (cm)	G	-0.156	-0.299*
	P	-0.028	0.072
Branches/ plant	G	0.222	-0.016
	P	-0.002	-0.002
Pods/ plant	G	0.120	0.071
	P	0.163*	0.019
Pod length (cm)	G	-0.220	0.268*
	P	-0.104	0.058
Seeds/ pod	G	0.043	-0.162
	P	0.080	0.122
Seed yield/ plant (g)	G		0.200
	P		0.052

P<0.05; ** P<0.01; G- Green plant colour group; P- Pigmented plant colour group

Table 4. Correlation coefficients among neurotoxin content and plant traits in leaf type group of *Lathyrus sativus* accessions.

		Seed yield/ plant (g)	ODAP (%)
Days to flowering	B	-0.098	-0.045
	N	-0.236**	0.004
Days to maturity	B	-0.083	-0.146
	N	-0.318**	-0.078
Plant height (cm)	B	-0.204	0.040
	N	0.034	-0.100
Branches/ plant	B	-0.033	-0.031
	N	0.181*	-0.075
Pods/ plant	B	0.108	-0.065
	N	0.306**	-0.185**
Pod length (cm)	B	-0.163	0.222*
	N	-0.066	-0.071
Seeds/ pod	B	0.004	0.116
	N	0.165*	-0.088
Seed yield/ plant (g)	B		-0.092
	N		-0.190*

* P<0.05; ** P<0.01; B- broad leaf type group; N- Narrow leaf type group

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