on wheat suggested that polyembryo formation can be caused by herbicides
used at a critical developmental stage (4). For this reason it is not clear
whether the observed variation between varieties in twin formation is based
mainly on genetical differences or on environmental conditions.

     The twin method for selection of haploids has been without any success
after examining 76,342 seedlings and investigating 89 twins cytologically.

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GENETIC VARIABILITY AND CORRELATIONS AMONG METRIC TRAITS OF SOME HIGl*i*
PROTEIN PEA LINES

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Most of the 19 high pea protein lines tested (PNL 10: 27-28) proved
to be low yielders. Grain yield of 16 such genotypes was also low (Fig. 1)
but most of them possessed considerable genetic variation for various yield
components, the maximum being in grain yield and the minimum in seed protein
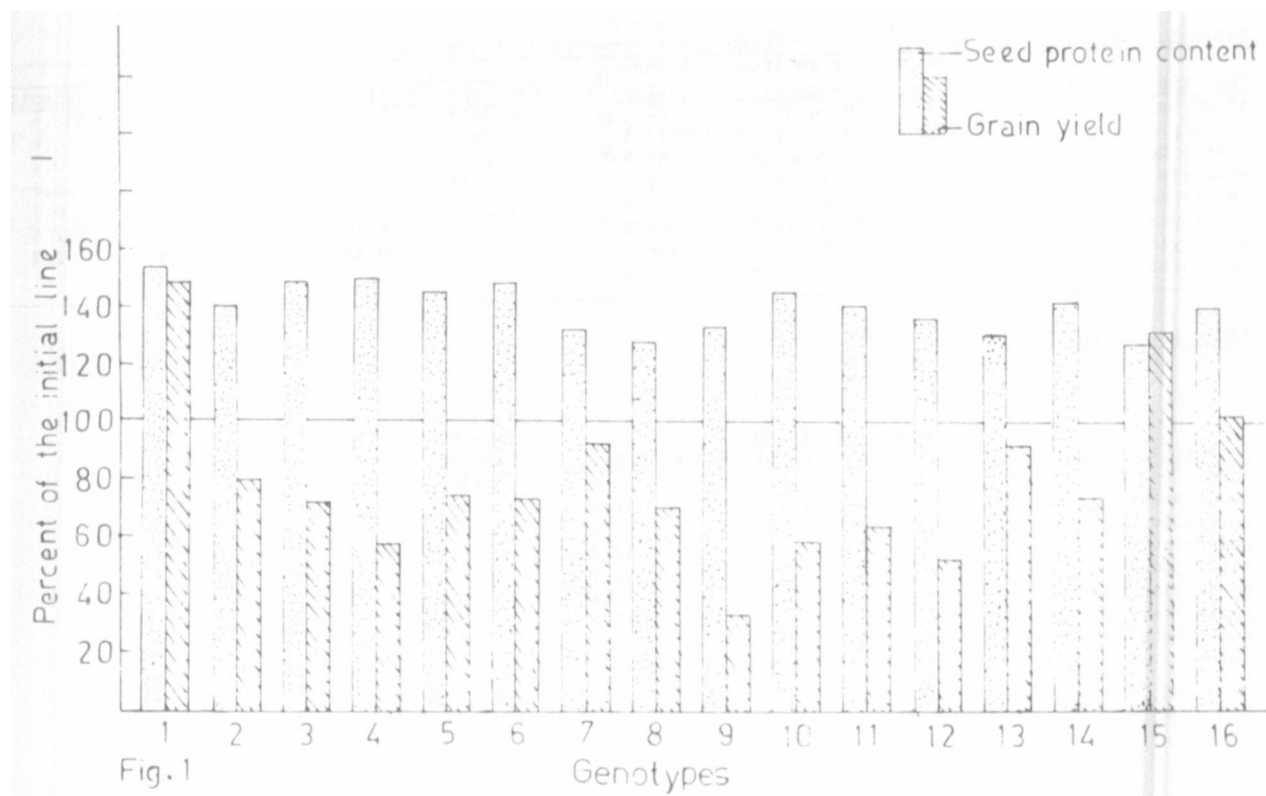content (Table 1). Since selection was directed towards higher seed protein

Fig. 1. Seed protein content and grain yield of 16(1-16) high protein pea genotyj

content, its variation was narrowed. The trait "seed number per plant" possessed the maximum phenotypic variability, genotypic coefficient of variation, heritability, and expected genetic advance (Table 1). Therefore, its selection value and breeding significance is high and the enhanced variability within the genotypes observed in this trait is due to a high degree of additive genetic effect. As shoot height possesses a high heritability and genetic advance, its control by major genes is inferred. Total grain yield (Y) is related to the various metric traits as follows:

Y = 5.67 - 0.01 X (X = shoot height); Y = 5.39 - 0.034 X (X = nodes per plant); Y = 5.73 - 0.262 X (X = internode length); Y = 0.95 + 0.290 X (X = pods per plant); Y = 2.77 + 0.702 X (Y = seeds per pod); Y = 1.22 + 1.07 X (Y = seeds per plant).

These regression equations imply a strong dependence of grain yield upon seed number per plant. This relationship is substantiated by the phenotypic, genotypic, partial and multiple correlation values (Table 2). Approximately 65-67% of the variance (R^2) in grain yield was accounted for by its association with seed and pod number per plant, the remaining being due to action and interaction of other variables including the environment.

Significant positive phenotypic and genotypic correlations between grain yield and seed number per plant, and the insignificant genotypic correlations between grain yield and shoot height indicate that selection of plants with increased seed number would produce plants higher in grain yield without influencing their stature significantly. Since sufficient genotypic variability exists in the "seed number per plant", it appears that the trait can be improved through recurrent selection without substantially affecting other traits.

Table 1. Estimates of variability in certain plant components of some high protein genotypes.

Phenotypic trait	Mean value	Variability range (%)	Standard range (%)	F value Genotype	F value Replication	Variance Phenotypic	Variance Genotypic
shoot height	105.4	50 -131	162	36.35**	1.40	720.4	561.6
nodes/plant	23.8	14 - 30	114.3	22.30**	0.66	19.9	13.6
internode length	4.4	2.9- 5.3	82.8	19.63**	1.24	0.6	0.4
pods/plant	12.1	5.3- 19.7	271.7	12.20**	0.31	23.8	12.6
seeds/pod	2.5	1.8- 4.2	133.3	26.79**	1.03	0.6	0.4
seeds/plant	33.0	11.9- 55.9	369.8	17.56**	0.46	210.9	131.5
grain yield/plant	4.3	1.8- 8.4	366.7	14.62**	0.52	3.8	2.2
seed protein content	26.4	24.4- 29.4	20.5	-	-	-	-

Table 1 (continued)

Phenotypic trait	Variation coefficient Phenotypic	Variation coefficient Genotypic	% Heritability	Genetic advance	Expected genetic advance
shoot height	25.3	22.3	77.9	43.1	40.6
nodes/plant	18.7	15.4	68.1	6.3	26.2
internode length	18.3	14.8	65.1	1.1	24.6
pods/plant	39.2	28.5	52.8	5.3	42.7
seeds/pod	29.3	24.9	62.1	1.1	43.6
seeds/plant	46.5	36.7	72.4	18.6	59.7
grain yield/plant	42.4	32.2	57.7	2.3	50.4
seed protein content	-	-	-	-	-

* P <0.05; P <0.01; N=480

Table 2: Coefficient of correlation values among   some metric traits

A. Bivariate phenotypic (above) and genotypic (below) correlation values

Variables:	N	I	P	Sp	S	Y (Yield)
Shoot height (H)	+.68** (+.75*)	+.71** (+.78*)	+.09 (.05)	-.59** (-.81)	-.27** (-.45)	-.16* (-.29)
Nodes/plant (N)		+.01 (+.18)	+.12 (+.11)	-.41** (-.59)	-.16* (-.29)	-.08 (-.18)
Internode length (I)			+.03 (.02)	-.40 (-.63)	-.19* (-.38)	-.11 (-.26)
Pods/plant (P)				-.19* (-.13)	+.78** (+.76*)	+.73** (+.65*)
Seeds/pod (Sp)					+.41** (+.52*)	+.27** (+.33)
Seeds/plant (S)						+.80** (+.69*)

B. Partial correlation values:

$r_{YS.H} = +.75^{**}$ $r_{YP.H} = +.79^{**}$ $r_{YSp.N} = +.81^{**}$ $r_{HY.N} = -.12$ $r_{H.Sp.N} = -.22^{*}$

$r_{YS.N} = +.74^{**}$ $r_{YP.N} = +.80^{**}$ $r_{YSp.I} = +.80^{**}$ $r_{HY.I} = -.09$ $r_{H.Sp.I} = -.19$

$r_{YS.I} = +.74^{**}$ $r_{YP.I} = +.80^{**}$ $r_{YSp.P} = +.55^{**}$ $r_{HY.P} = -.31^{**}$ $r_{H.Sp.P} = -.55^{**}$

$r_{YS.P} = +.81^{**}$ $r_{YP.Sp} = +.75^{**}$ $r_{YSp.S} = +.79^{**}$ $r_{HY.S} = +.22$ $r_{H.Sp.S} = -.03$

$r_{YS.Sp} = +.13$ $r_{YP.S} = +.78^{**}$ $r_{YSp.H} = +.80^{**}$ $r_{HY.Sp} = +.12$ $r_{H.Sp.Y} = -.26^{*}$

C. Multiple correlation values:

$R_{Y.Sp\ H} = +.81^{**}$ ($R^2 = .65$) $R_{Y.H\ N} = +.15$ ($R^2 = .021$)

$R_{Y.Sp\ N} = +.81^{**}$ ($R^2 = .65$) $R_{Y.H\ I} = +.15$ ($R^2 = .021$)

$R_{Y.Sp\ I} = +.81^{**}$ ($R^2 = .65$) $R_{Y.H\ P} = +.76^{**}$ ($R^2 = .58$)

$R_{Y.Sp\ P} = +.82^{**}$ ($R^2 = .67$) $R_{Y.H\ Sp} = +.27$ ($R^2 = .08$)

$R_{Y.Sp\ S} = +.81^{**}$ ($R^2 = .65$) $R_{Y.H\ Sp} = +.81^{**}$ ($R^2 = .65$)

(*P < 0.05,   **P < 0.01, N = 160)