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NUTRITIONAL AND ANTINUTRITIONAL FACTORS OF GRASS PEA (*LATHYRUS SATIVUS*) GERMPLASMS

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ABSTRACT. A set of 25 high yielding varieties of grass pea samples under trial in the Institute of Agriculture Research were analyzed for their content of certain nutrients and antinutrients. A significant variation in the contents of NPN (0.4-0.5%), NPN as percentage of total N (9.3-11.4%), total protein (22.6-28.1%), true protein (20.4-25.5%), fat (1.0-1.6%), ash (1.0-2.1%), phosphorus (380.4-511.6 mg/100 g), starch (32.0-43.9%), iron (6.6-18.4 mg/100 g), calcium (131.6-200.1 mg/100 g), phytate (525-1028 mg/100 g), tannin (500-856 mg/100 g), trypsin inhibitor (16783-26183 IU/g) and ODAP (172-353 mg/100 g) in the grass pea varieties was observed. Crude fibre (7.2-8.3%), total carbohydrate (51.8-58.5%), total sugars (5.1-6.2%) and reducing sugars (1.5-1.9%) contents of the grass pea varieties did not vary significantly. The nutrient composition and the content of antinutritional factors revealed that the high yielding varieties are not significantly different from local grass pea land races. The large variability obtained in most of the nutritional characters among twenty five germplasm collections suggest that it may be possible to select materials of a higher nutritional quality, lower antinutritional factors and desirable agronomic traits for breeding.

INTRODUCTION

Lathyrus sativus L., the grass pea, is one of the important legumes in Ethiopia. It occupies 8.7% of the total area of crops production and contributes 7.6% of the total production of food legumes in Ethiopia [1]. Produced in areas with adverse agricultural conditions, it performs well on heavy black soils that tend to waterlog. Grass pea production in Ethiopia is mainly concentrated in the northwest (58%), the central (16.3%), northeast (12.8%) and northern as well as southeastern (12.9%) regions of the country.

Like most crops in Ethiopia, grass pea seeds are used for human consumption. The legume is also widely cultivated and consumed as food in India, Bangladesh, Pakistan, China, Nepal and the nearby counties [2]. Grass pea is commonly consumed as snack in the boiled (*Nifro*) and roasted (*Kolo*) forms. The flour of roasted grass pea seeds is used for the preparation of the traditional Ethiopian sauce or gravy called *Shiro Wot*. The unleavened bread (*Kita*) from grass pea is consumed only during acute food shortages, and in some of the villages that were repeatedly affected by flooding.

In addition to high protein content, grass pea also contains a neurotoxin, β-N-oxalyl-L-α,β-diaminopropionic acid (ODAP) and other antinutritional factors such as phytate, trypsin inhibitors and tannin, which may limit the nutritional and food qualities of this legume [3,4,5]. Phytate, widely distributed in food grains [6], lowers the bioavailability of minerals [7]. All legumes studied to date, have been found to contain trypsin inhibitors in varying

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amounts [8]. Trypsin inhibitors when ingested by man in significant amounts disrupt the digestive process [8]. Similarly, tannin inhibits the activities of trypsin, chymotrypsin, amylase and lipase [9].

In Ethiopia, agronomic studies on grass pea were initiated at the Institute of Agricultural Research (IAR) with the aim of collecting, maintaining and evaluating grass pea germplasms for various quantitative and qualitative characters. Screening and evaluation of grass pea germplasms was conducted at the Adet Agricultural Research Station, Gojam, Ethiopia. The experiments were laid out in a simple lattice design with two replications. Each entry was planted in a four-row plot of 2 m length with 50 cm x 30 cm inter-row spacing. The crop was sown in the first week of October and received no basal dressing of fertilizers and no irrigation was given at the critical crop growth [10].

Attempts to develop toxin-free cultivars of grass pea have yet to meet success. However, identification of varieties with high nutritional quality and low ODAP content is one of the ways to utilize the crop and combat lathyrism. The present study has, therefore, been undertaken to analyze nutritional and antinutritional factors of 25 grass pea germplasm accessions which may enhance breeding programs for increased yield and nutritive value.

EXPERIMENTAL

Sample preparation. Seed samples of 25 grass pea germplasm accessions were obtained from the Adet Agricultural Research Station, Gojam, Ethiopia. The Seeds were sown in the farm of the Research Station during 1988. The grains were cleaned by hand to remove extraneous materials and freed from broken seeds, ground in a Cyclotec (Tecator-AB, Sweden) sample mill with 0.1 mm mesh sieve and held in glass jars at 4° until used for analysis.

Chemical analyses. Moisture, crude fibre and ash were assayed according to the AOAC [11] methods. Total nitrogen was determined by the micro-Kjeldahl procedure of AOAC [11] and a nitrogen to protein conversion factor of 6.25 was used. Non-protein nitrogen (NPN) was determined as the nitrogen [12] in the supernatant recovered after having precipitated the protein from solution by means of trichloroacetic acid (24%, w/w) followed by filtration through Whatman No.4 filter paper. True protein was calculated as the difference between total N and NPN, times 6.25. Total fat was extracted with hexane according to the method of AOAC [11]. The neurotoxin ODAP was estimated according to Rao [13]. Energy values were computed using physiological fuel values of protein, carbohydrate and fat. Total carbohydrate content was determined by subtracting the weights of total protein, crude fibre, fat and ash from the total dry matter.

Total sugars, other than starch, were extracted with ethanol by reflux method and were estimated colorimetrically according to Dubois, *et al.* [14]. Starch from sugar free pellet was estimated by the method of McReady, *et al.* [15]. Reducing sugars were estimated by the method of Nelsen [16] and non-reducing sugars calculated by the difference between total sugars and reducing sugars.

The method of vanillin hydrochloride described by Maxon and Rooney [17] was employed for the estimation of tannin content using catechin as a standard. The tannin content was expressed as catechin equivalents (mg/100 g, dry wt).

Determination of phytic acid content in grass pea samples was carried out according to the method of Haug and Lantzsch [18]. The trypsin inhibitor activity was determined by the method of Kakade, *et al.* [19]. N-Benzoyl-DL-arginine-*p*-nitroaniline (BAPNA) was

used as the trypsin substrate. Total trypsin inhibitor activity was expressed as TIU/g (dry weight).

Total iron was determined using bathophenanthroline as described in AOAC [11], phosphorus by the Fiske-Subbarow method [20] and calcium according to the AOAC [11].

Statistical analysis. Samples from each variety were analyzed five times. Data were analyzed by analysis if variance using the SPSS system to locate difference between variety means at the 5% level of significance.

RESULTS AND DISCUSSION

The proximate composition of the grass pea germplasm accessions are given in Table 1. The total meal nitrogen (N) in these lines varied between 3.6 to 4.4%. Values for total protein varied from 22.6 to 28.1% being within the normal range. The mean total protein content was 25.1% (CV = 4.6%). The lowest total protein content was detected in varieties 201545 and 201547b.

Table 1. Proximate composition of 25 grass pea varieties (%)[a].

Variety	Moisture	TN[b]	P[c]	TP[d]	NPN	NPN/N	Fat	Crude fibre	Ash
46030	8.7±0.3	4.2±0.2	26.4±1.3	23.9±0.0	0.4±0.1	9.5±0.6	1.3±0.1	7.3±0.2	1.5±0.1
46050	7.1±0.4	3.9±0.1	24.1±1.2	21.7±1.2	0.4±0.1	9.8±0.4	1.2±0.1	7.5±0.5	1.6±0.1
46052	8.5±0.2	4.0±0.2	25.0±1.4	22.3±1.3	0.4±0.1	10.8±0.4	1.2±0.1	7.5±0.5	1.8±0.2
46053	9.6±0.2	4.5±0.2	28.1±1.6	25.5±1.4	0.4±0.1	9.3±0.5	1.2±0.2	7.2±0.0	1.9±0.3
46054a	8.1±0.3	4.4±0.2	27.2±1.4	24.3±1.0	0.5±0.1	10.6±0.5	1.6±0.2	8.0±0.4	2.0±0.1
46054b	8.9±0.2	4.1±0.2	25.7±1.2	23.3±1.5	0.4±0.1	9.5±0.4	1.4±0.1	6.8±0.5	1.5±0.0
46058	8.9±0.4	4.0±0.1	24.9±1.0	22.5±1.3	0.4±0.1	9.8±0.6	1.5±0.2	7.2±0.4	1.9±0.1
46060	8.2±0.2	3.9±0.2	24.4±1.2	22.1±1.2	0.4±0.0	9.5±0.4	1.2±0.1	7.2±0.3	1.8±0.1
46070	8.5±0.1	4.0±0.1	25.0±1.3	22.3±1.0	0.4±0.1	10.0±0.5	1.1±0.1	7.7±0.3	1.8±0.3
46071	7.5±0.4	4.1±0.2	25.6±1.4	23.0±1.4	0.4±0.1	10.2±0.3	1.3±0.2	8.1±0.3	2.1±0.4
46072	8.6±0.2	4.1±0.2	25.4±1.6	22.7±1.0	0.4±0.0	10.6±0.4	1.3±0.2	7.7±0.4	1.8±0.1
46073	7.5±0.1	3.9±0.2	24.6±1.3	22.0±1.1	0.4±0.0	10.4±0.5	1.0±0.1	7.7±0.2	1.8±0.1
46074	7.6±0.3	4.2±0.2	26.3±1.5	23.7±1.2	0.4±0.0	9.9±0.4	1.3±0.2	8.3±0.3	2.1±0.2
46075	8.9±0.4	4.0±0.2	24.9±1.0	22.5±1.1	0.4±0.0	9.8±0.5	1.5±0.2	7.2±0.5	1.9±0.1
46076	7.4±0.3	4.0±0.2	24.8±1.0	22.4±1.1	0.4±0.1	9.6±0.3	1.4±0.1	8.1±0.4	1.9±0.2
46078	8.5±0.2	3.8±0.2	24.0±1.3	21.5±1.2	0.4±0.0	10.4±0.4	1.1±0.3	7.7±0.6	1.8±0.1
46080	7.7±0.1	3.9±0.2	24.2±1.1	21.8±1.6	0.4±0.0	9.8±0.6	1.2±0.2	7.2±0.5	1.8±0.3
201513	8.3±0.1	4.1±0.2	25.7±1.3	23.3±1.2	0.4±0.0	9.5±0.5	1.2±0.2	7.2±0.6	1.7±0.4
201538	7.1±0.2	3.9±0.2	24.1±1.5	21.7±1.4	0.4±0.0	9.8±0.5	1.2±0.2	7.5±0.4	1.6±0.2
201540	7.4±0.2	4.1±0.2	25.4±1.5	22.9±1.1	0.4±0.0	9.9±0.5	1.0±0.0	7.7±0.3	1.5±0.3
201543	7.3±0.3	4.1±0.2	25.3±1.6	22.5±1.0	0.5±0.0	11.1±0.5	1.2±0.0	7.7±0.4	1.5±0.4
201545	8.9±0.2	3.6±0.1	22.6±1.2	20.4±1.0	0.4±0.0	9.9±0.4	1.3±0.2	7.8±0.4	2.1±0.5
201547a	7.6±0.3	4.1±0.1	22.5±1.3	23.1±1.4	0.4±0.0	9.3±0.6	1.4±0.3	7.3±0.4	1.5±0.2
201547b	7.3±0.1	3.8±0.2	23.6±1.1	21.3±1.2	0.4±0.0	9.8±0.4	1.2±0.2	7.7±0.3	1.6±0.1
201547c	7.4±0.3	3.9±0.2	24.2±1.4	21.5±1.4	0.4±0.0	11.4±0.4	1.1±0.0	7.6±0.4	1.8±0.0
Mean	8.1±0.3	4.1±0.2	25.1±1.2	22.6±1.1	0.4±0.0	10.0±0.5	1.3±0.2	7.6±0.4	1.8±0.2
CV, %	3.1	4.4	4.6	4.8	6.5	5.5	11.9	4.7	1.0

[a] mean ± S.D. of five replications.
[b] total meal nitrogen.
[c] total protein.
[d] true protein.
CV = coefficient of variation.

The mean NPN as percentage of the meal varied between 0.4 and 0.5% with a mean value of 0.4% (CV 6.5%). Among the varieties studied, 46054a contained significantly higher NPN. On the other hand, when expressed as percentage of the meal N, NPN varied between 9.3 and 11.4% and showed a lower, but appreciable, correlation ($r=0.4100$) with the percentage of N in the meal. Although the NPN constitutes a small portion of the total protein, its effect on the quality of grass pea protein products cannot be ignored. Therefore, whether expressed either as percentage of the total N, NPN increased when the total N in the meal increased. Data on NPN in the present study compares favorably with the NPN content of lima beans, black-eye peas and chick peas but lower than the NPN levels in dry beans [21]. It is evident from these results that all N present in grass pea is not associated with seed protein, suggesting that NPN has to be taken into account if total protein in the diet is to be measured accurately.

The mean true protein content corrected for the NPN was 22.6% (CV 4.8%) with the varieties 201545 and 2015547b having the lowest average value of about 20.4 and 21.3%, respectively.

The fat (ether extract) contents varied from 1.0 to 1.6%. Varieties 46073 and 201540 showed the lowest fat content (1.0%) while the highest fat content was observed in variety 46054a (1.6%). However, the overall mean fat content (1.3%, CV 11.9%) was higher than the values given for chick peas [22]. The ash contents of the grass pea varieties ranged form 1.5 to 2.1% with a mean value of 1.8% (Table 1). These values are in agreement with the values of ash content for chick peas as reported by Agarwal and Bhattacharya [22].

Small variation was noted in the crude fibre content of the 25 varieties of grass pea germplasm accessions (Table 1). Variety 46074 showed the highest crude fibre content. Agarwal and Bhattacharya have reported variation in crude fibre ranging from 7 to 11% in chick peas [22]. In the present investigation, a number of varieties had similar fibre content. The energy value of grass pea varieties ranged from 316.8 to 351.5 kcal/100 g meal (Table 2). Wide variation was not observed in the energy composition of the grass pea varieties.

The carbohydrate components of grass pea varieties are given in Table 2. Variety 46053 showed the lowest total carbohydrate content (51.8%). The carbohydrate content was as high as 58.5% in the case of variety 46050.

Starch contents of the grass pea varieties varied from 32.0 to 43.9%. Variety 46054b had significantly lower starch content (32.0%) than the rest of the varieties studied. Lower starch contents were measured for varieties higher in total nitrogen ($p<0.05\%$). Varieties 201547a and 201547c had significantly less reducing sugars than other grass pea varieties. Total sugars also varied according to the varieties. It was also noted that sugar contents were high in the varieties with high fat and ash ($p<0.05\%$) content. However, the values for carbohydrate components in the grass pea germplasm accessions are consistent with those reported for chick peas [22].

Calcium content ranged between 132 and 200 mg/100 g sample, a significant variation (Table 3). Similar variations in iron content were observed. Variety 46054a contained the highest amount of iron while variety 201545 contained the highest amount of calcium. The results suggest the possibility of identifying genotypes with higher calcium and iron contents which are nutritionally important.

The antinutritional factors were measured as the activity values of trypsin inhibitors, phytic acid and as the tannin content (Table 3). The tannin content, given as catechin equivalents of the dry matter, ranged in contents from about 500 to 856 mg/100 g depending on the grass pea varieties. Among the 25 varieties, 46053 contained the highest amounts of tannin (856 mg/100 g) followed by varieties 201510 (850 mg/100 g), 201547c (820 mg/100 g) and 46080 (820 mg/100 g). Variety 46071 had the lowest tannin content of 500 mg/100 g. Variation in the tannin content of the varieties of the grass pea were,

however, large (CV 21.1%). The seed coat of the grass pea cultivars was pigmented which may explain the relatively large amount of tannin present in them. The grass pea having the darkest color contained the highest amount of total tannin indicating that the tannin contents may be a function of color of the seed coat. The tannin in grass pea varieties are lower than in pigeon pea and black gram but higher than in chick peas and green gram [23]. The grass pea in the present study are anticipated to have poor nutritive value compared to some legumes due to the presence of significant levels of tannin which is known to affect digestibility of protein, carbohydrates and fat, and bioavailability of minerals [24]. Tannin in the grass pea varieties significantly correlated positively with meal nitrogen, calcium and iron but negatively with fat, ash, and carbohydrate.

Table 2. Carbohydrate components and energy values of grass pea varieties*.

Variety	Total carbohydrate (%)	Starch (%)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Energy (kcal/100g)
46030	57.8±1.9	33.7±2.9	5.2±0.3	1.6±0.1	3.6±0.2	348.5±16.2
46050	52.4±2.1	36.7±3.1	5.2±0.2	1.6±0.0	3.6±0.4	316.8±15.1
46052	55.0±1.7	41.6±2.7	5.2±0.3	1.6±0.4	3.6±0.1	330.8±17.1
46053	52.7±1.4	35.3±2.5	5.4±0.2	1.6±0.1	3.8±0.5	334.0±13.2
46054a	52.4±1.8	38.0±2.9	5.6±0.4	1.7±0.1	3.9±0.0	332.8±11.3
46054b	54.6±2.0	32.0±3.0	5.2±0.3	1.6±0.0	3.6±0.1	333.8±15.2
46058	59.6±1.9	38.9±3.1	5.5±0.6	1.7±0.0	3.8±0.3	351.5±12.3
46060	56.4±1.8	43.9±2.8	5.2±0.3	1.6±0.1	3.7±0.1	334.0±14.1
46070	56.4±2.1	39.6±3.1	5.6±0.4	1.7±0.2	3.9±0.4	331.5±14.4
46071	55.0±2.0	38.5±2.9	5.5±0.5	1.7±0.1	3.8±0.0	329.9±13.7
46072	54.6±1.5	35.1±2.5	5.3±0.0	1.6±0.0	3.7±0.6	332.5±13.9
46073	56.4±1.4	34.9±2.4	5.1±0.4	1.6±0.0	3.5±0.2	338.9±15.1
46074	54.0±2.0	35.3±2.5	5.4±0.5	1.6±0.2	3.8±0.4	323.4±14.6
46075	55.1±1.4	37.8±3.0	5.9±0.2	1.8±0.1	4.1±0.1	337.3±16.7
46076	55.8±1.6	39.7±2.6	5.8±0.0	1.7±0.1	3.8±0.0	336.3±11.9
46078	54.6±1.8	33.7±2.8	5.3±0.3	1.6±0.2	3.7±0.0	330.2±17.1
46080	57.1±1.5	40.5±2.4	5.2±0.4	1.6±0.0	3.6±0.3	336.0±14.2
201513	55.1±1.7	36.1±3.0	5.7±0.3	1.7±0.1	4.0±0.2	334.0±18.3
201538	57.4±2.2	37.9±3.2	5.7±0.1	1.6±0.1	4.1±0.2	336.8±14.3
201540	55.6±2.0	39.4±2.7	5.2±0.0	1.6±0.2	3.6±0.0	333.0±14.2
201543	55.8±2.1	38.8±3.1	5.4±0.2	1.6±0.0	3.8±0.4	335.2±15.2
201545	57.1±1.9	41.5±2.9	6.2±0.3	1.9±0.0	4.3±0.1	330.5±14.7
201547a	57.7±1.5	37.8±2.4	5.1±0.4	1.5±0.1	3.6±0.0	345.4±13.9
201547b	57.8±1.8	42.1±2.8	5.4±0.5	1.6±0.2	3.8±0.2	336.3±15.0
201547c	57.0±1.9	38.2±2.9	5.2±0.2	1.5±0.0	3.7±0.1	334.7±15.1
Mean	55.7±1.8	37.9±2.9	5.4±0.3	1.6±0.1	3.8±0.2	334.6±14.7
CV, %	3.2	7.7	5.1	5.3	5.1	4.4

* mean ± S.D. of five replications.
CV = coefficient of variation.

Phytic acid among the varieties ranged from 525 to 1028 mg/100 g (Table 3). Variety 46050 had the highest amount of phytate followed, in descending order, by varieties 46073, 46052 and 201513. The variety 201513 had a phytic acid level of 500 mg/100 g, which was 30-40% less than other varieties. However, the level of phytic acid in grass pea cultivars seemed to be lower than that reported for black gram [25] and soy beans [6], but higher than the phytate of green gram, chick pea and cow pea [26], thus suggesting that the nutritional value of raw grass pea seeds would be impaired to a comparatively lesser extent.

Besides lowering the bioavailability of minerals, phytate is also reported to lead to hard-cooking process [7,27]. The phosphorus, as phytate, in the grass pea seed varieties constituted the major portion of total phosphorus content (*ca* 52%). The ratio of phytate phosphorus as percentage of total phosphorus did differ significantly between the varieties. This ratio was highest in varieties 46050 (66%) and 46052 (56.8%) and lowest in varieties 201543 (38.5%) and 46076 (35.8%). The values obtained for ratio of phytate phosphorus to total phosphorus, in most of the grass pea varieties, appear to be higher than the values reported for the soy beans, cow pea and lima beans [28].

Table 3. Level of minerals and antinutritional factors in 25 grass pea varieties[a].

Variety	Fe (mg/100g)	Ca (mg/100g)	P (mg/100g)	Phytate[b] (mg/100g)	Phytate-p as % P	Tannin[c] (mg/100g)	TI[d] (IU/g)	ODAP[e] (mg/100g)
46030	8.3±4.6	178±33	463±39	878±151	53.3±5.1	710±95	16783±2921	263±43
46050	6.6±3.2	134±22	439±38	1028±152	66.0±4.1	600±108	17760±2812	231±34
46052	11.1±3.8	133±23	472±35	952±147	56.8±4.6	658±107	18095±2418	214±41
46053	10.7±2.7	154±22	431±36	715±150	46.8±4.7	856±92	24070±3237	271±45
46054a	18.4±3.7	179±29	492±30	735±140	42.1±5.5	776±108	24330±3234	254±42
46054b	7.0±2.4	177±27	512±37	992±146	54.6±5.5	675±103	18080±3081	193±28
46058	8.2±3.5	177±25	423±35	768±142	51.2±4.9	585±106	17631±3017	281±54
46060	8.0±4.1	178±33	475±39	863±150	51.2±7.1	585±102	22820±3121	273±39
46070	7.7±4.0	156±33	390±34	578±140	41.7±5.7	675±105	25320±3327	294±38
46071	7.5±3.9	132±24	461±40	798±146	55.3±8.3	500±103	25730±3282	291±54
46072	7.3±2.9	132±32	389±39	983±151	71.2±7.4	600±109	19367±3117	281±53
46073	6.9±3.1	133±24	458±33	875±153	53.8±6.8	700±101	23760±2762	282±28
46074	7.0±4.2	133±21	435±35	858±146	55.6±5.6	675±100	18890±2781	254±45
46075	9.4±4.7	178±29	429±32	732±147	48.1±6.4	765±107	21170±2817	353±52
46076	7.2±2.4	134±27	454±34	622±143	88.6±6.1	520±108	20130±2982	293±42
46078	7.4±2.8	178±18	413±35	677±145	46.2±5.6	717±97	20173±2816	314±42
46080	16.9±3.9	177±20	416±36	640±149	43.4±5.4	820±106	26183±2917	272±41
201513	11.0±4.4	134±24	482±35	942±153	55.1±6.5	767±102	17870±3037	314±41
201538	18.1±4.0	176±22	479±37	817±150	51.3±6.7	780±98	20860±3161	194±42
201540	11.4±4.1	176±23	408±39	678±148	46.8±5.8	850±98	16730±2823	223±42
201543	6.9±3.7	132±19	413±40	525±148	35.8±4.9	800±104	21630±3019	221±39
201545	8.0±3.8	200±19	381±40	625±146	46.2±5.3	670±107	23220±3227	297±31
201547a	6.7±3.6	176±28	424±35	642±143	42.7±4.9	558±103	19231±2815	172±38
201547b	13.2±4.1	79±29	380±34	538±143	39.9±6.3	618±100	19065±2763	253±42
201547c	7.8±2.9	198±21	435±37	797±146	51.6±6.1	820±99	19736±2932	252±40
Mean	10.0±4	161±24	441±38	770±147	51.8±5.7	691±103	20745±2977	261±42
CV, %	37.4	14.6	8.6	19.0	11.0	21.2	14.1	16.6

[a] mean ± S.D. of five replications.
CV = coefficient of variation.
[b-e] values are expressed on dry weight basis.

Significant positive correlation was noted with the phytate content and all of the variables considered in this study particularly phosphorus, reducing sugars and non reducing sugars. However, the correlation was significantly negative between starch and phytate contents.

Trypsin inhibitors of the grass pea varieties, expressed as TIU per gram of pulse meal (TIU/g) varied from 16730 to 26183 TIU/g. The highest value was detected in variety 46080. When compared with other common legume seeds like whole common beans [29], soy beans [30], and cow peas [31], the trypsin inhibitor content in grass pea varieties was

considerably low, but, high compared to trypsin inhibitors in chick peas [22]. The trypsin inhibitors in the present study negatively correlated with ash ($p<0.05\%$) and phytate ($p<0.05\%$) levels. The presence of trypsin inhibitors in *Lathyrus sativus* may be of some nutritional significance, since the heat treatment used in the preparation of *Chapatti* (unleavened bread made of wheat flour), which is commonly used in the diet in India, results in a destruction of only about 50% of the inhibitor [5].

The neurotoxin compound, ODAP, content of the grass pea varieties is shown in Table 3. Frequency distribution indicates that the grass pea germplasm accessions contain 252-353 mg/100 g and a small number contains 172-231 mg/100 g of ODAP. Variety 46075 had the highest content of ODAP followed, in descending order, by varieties 46078, 201945 and 46076. The grass pea variety 201547a had an ODAP content of 172 mg/100 g which was about 40% less than the mean ODAP content of all the grass pea varieties. Multiple regression analysis showed that ODAP varied with the grass pea varieties depending on levels of the calorie, starch, calcium, fat, ash and reducing sugars. However, the ODAP content was considered low in all the grass pea varieties studied.

In conclusion, a large variability was found in most of the nutritional characters among the twenty five grass pea germplasm collections. Such variability may be used to select varieties lower in ODAP and other antinutritional factors but higher in nutritional quality and desirable agronomic traits.

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