Exploring Biochemical Changes and Nutritional Composition in Mungbean Genotypes

it needs to be re-arrange since it is more general and is not specific to the main research activities computed by the researcher as discussed under results and discussion part

Abstract

During the Rabi season of 2018-19, an experiment was undertaken at the C.S.A University of Agriculture and Technology, Kanpur's pulse research farm kalyanpur to investigate the biochemical investigation of several promising genotypes~~/varieties~~ (since all genotypes might not be considered as a variety, it is not possible to use the word "Genotype" and "variety" interchangeably)of mung bean [*Vigna radiata* (L)]. The nutritional quality flour and characteristics such as the overall range of variability of ~~no.~~number of pods per plant, maturity period, yield in gram~~me~~ per plant, moisture content, methionine and tryptophan content were found to be 18-27, 60-70 percent, 2.90-5.94g/plant, 0.38 to 5.68, 0.35-0.72g/16gN, and 1.30 to 1.80g/16gN in mung bean ~~varieties/genotypes~~(use either genotype or variety based on the historical description of the mung bean materials used in your research), respectively. The genotypes IPM-02-3, KM-2268, KM-2328, KM-2364, KM-2260, KM-2362 of the varietal trail were found to have the highest number of pods per plant, lowest moisture percentage, lowest maturity period, yield in gram~~me~~ per plant, and greater nutritional contents ~~viz.~~(don'tsuch an abrevatted terms in the abstract which might creat confusion for readers) methionine and tryptophan content.

Keywords: Methionine, Moisture content, Nutritional quality, Tryptophan,Yield.

Introduction

Food is necessary for nutrition since it contains various nutrients that allow the body to grow and sustain energy, as well as perform critical living activities and offer material for tissue upkeep. For thousands of years, people have eaten Leguminosae (legume family) pulses. They contain a lot of protein and are very easy to digest (~~ASIF *et al.*,2013~~Old citation). Pulses are known as the poor man's meat and are grown for human consumption all over the world due to their high nutritional value and inexpensive cost, which helps developing nations like India overcome protein deficiency (~~MEHTA *et al.*, 2005~~Old citation). In terms of pulse production, consumption, and imports, India is the world's greatest producer, consumer, and importer.

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Pulses, on average, contain 20-30% protein, which is 2 to 2.5 times higher than grains(Sozer *et al.* 2017). Total food grain production forecasts for 2019-20 are at a new high of 291.95 million tonnes, up 6.74 million tonnes from the previous high of 285.21 million tonnes in 2018-19 (ANONYMOUS, 2018). Pulses have a distinctive role in the cropping system, serving as a major catch cover, green manure, and intercrop. Pulses are an important part of the Indian diet, as they are one of the most effective sources of protein(Meena *et al.* 2018;~~Das *et al.* 2016~~Old citation). Pulses should be consumed at a rate of 80 grammes per capita per day, according to WHO recommendations.The Fabaceae family and subfamily Papilionaceae include the mungbean. In India, the mungbean [Vignaradiata (L.)] is known as moong or green gramme (Akter *et al.*, 2020). Mungbean is an important Kharif crop in Uttar Pradesh, with a total yield of 0.14 lakh tonnes and a seed demand of 8.92 thousand quintals. [DES Normal 2020 (Average- 2014-15 to 2018-19)] Mung (green gramme) is a high-protein food. It has a protein content of roughly 25%. Mungbean is used in a variety of cuisines as a whole grain and as a dhal. Sprouted mungbean grain is used in South India to make curry or savoury dishes, but it is usually utilised in Northern India as dhal and moth bean. It is said to be quite nourishing (Naik*et al*,. 2020; Gurusamy *et al.*, 2022).This crop is an excellent source of quickly digestible protein, and it plays an essential part in providing India's protein nutritional needs. The whole or split mungbean grains are used as a pulse or ground into flour. It does not cause flatulence, unlike other pulses.

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MATERIALS AND METHODS

To prepare dhal and flour samples, all mungbean samples were oven dried at 70 °C overnight, chilled at room temperature, and ground in a household grinder before passing through a 20-mesh screen. Petrolium ether (40-60 °C) was used to defat the samples. The flour was kept at room temperature in screw-capped vials in a desiccator before being utilised for biochemical analysis. The model used Completely Randomized Design to assess the experiment's observed data (CRD). The numberof genotypes, spacing between blocks and plots, seed rate and fertilizer rate should be included to make the experimental design and treatment arrangement more informative.For determining protein content, see (L.P. AND YOUNG, V.R., 1980). According to (HORN *et al.*, 1946), the sample's methionine content was determined using a calorimetric method. (SPIES AND CHAMBERS, 1949) determined the tryptophan content of the sample.Additionally, it is better to include crude protein, fat or lipid, vitamins, minerals, dietary fiber, carbohydrate and other very important nutritional quality traits.

Determination of Biochemical Changes and Nutritional Compositions

Methionine content:

Methionine content of the sample was determined by calorimetric method as reported by (Horn *et al.*, 1946). Sulphur containing essential amino levels of methionine is a first limiting amino acid of legume grains. Inadequate levels of methionine quantitative affect the nutritive value of legume protein. Therefore, quantitative estimation of methionine in the grains of different varieties of legumes is important in assessing its protein quality form the point of view of selecting out nutritionally superior varieties.

Principle:

The protein in the grains is first hydrolyzed in a moderate acidic environment. Under alkaline conditions, the released methionine produces a yellow hue with nitroprusside solution, which becomes red when acidified. Glycine is added to the reaction mixture to suppress colour, which is detected using a spectrophotometer at 520nm.

~~**Materials:**~~ **It is no necessary to list thses materials since they all are already discussed under the procedure**

- ~~2N hydrochloric acid~~
- ~~10 NaOH (40%)~~
- ~~Sodium nitroprusside (10%)~~
- ~~Glycine (3%)~~
- ~~Orthophosphoric acid (Sp.gr. 1.75)~~
- ~~Standard methionine: dissolving 100 mg of DL methionine in 4 mL of 20% HCl and diluting to 100mL with water~~.

Procedure:

1. Transfer 0.5 g of defatted material to a conical flask with a volume of 50 mL. Add 6ml of 2N HCl and autoclave for one hour at 15 psi.
2. Bring the hydrolysate (autoclaved sample) to a boil with a pinch of activated charcoal. Filter when hot and wash the charcoal with hot water
3. After cooling to room temperature, neutralize the filtrate with 10N NaOH to pH 6.5 and dilute to 50 mL with water.
4. Pour 25 mL of the prepared solution into a 100mL conical flask.
5. Add 3ml of 10% NaOH and 0.15ml of sodium nitroprusside.
6. After ten minutes, add one millilitre of glycine solution.

7. After another minute, add 2 orthophosphophoric acid and aggressively shake.
8. After 10 minutes, compare the intensity of the red colour at 520nm to a blank made in the same manner but without nitroprusside.

Standard curve:

Pipette out 0,1,2,3,4, and 5ml of standard solution and dilute with water to 25ml. Steps 5-8 should be followed to produce the colour in the standards. The 0 level represents a blank.

Calculation:

The graph is used to compute the methionine content and the standard curve. Methionine in the sample = (graph methionine content x 4) mg/g.

Methionine is often measured as a percentage of protein or as g/16gN.

$$\text{Methionine content of the sample} = \frac{\text{Methionine content from the graph x 6.4}}{\text{Percentage of N in the sample}}$$

(It is better to give an equation number for this equation)

Tryptophan content:

Tryptophan content of the sample was determined by the (Spies &Chambers, 1949). Tryptophan is also a limiting amino acid of most of the legume grains, the inadequate presence of which affect the quality of an important step in evaluating quality of legume protein.

Principle:

Tryptophan is very acidic, which results in a blue-colored derivative with p-dimethyl-aminobenzaldehyde in the presence of sodium nitrite. The colour intensity of derivatized tryptophan is measured spectrophotometrically at 545nm to determine the tryptophan concentration of the sample.

Materials:

- 19 N Sophoricoside.
- Dimethyl-amino benzaldehyde.
- 0.45% Sodium nitrite

Standard tryptophan:

Dissolve 10mg tryptophan (0.1 mg/ml) in 100 mL distilled water. To get a clear solution, add a few drops of sulphuric acid to dissolve the Tryptophan.

Procedure:

1. Transfer a weighted 100mg air dried, powdered, and defatted grain sample to a 50 ml stoppered conical flask.

2. Shake well after adding 30mg Dimethyl-amiobenzaldehyde and 10ml of 19N H2SO4 solution.
3. Incubated the test mixture in a conical flask at room temperature for 12 hours in the dark.
4. Centrifuge at 5000 rpm for 15 minutes to obtain the supernatant.
5. Add 0.1 mL of 0.45% NaNO2 solution and thoroughly mix.
6. After 30 minutes, check the blue hue at 545 nm.
7. Set blank without sample and repeat steps2-6.

Standard curve:

Pipetted out 0, 0.2, 0.4, 0.6, 0.8-, and 1.0-mL standard tryptophan and diluted to 1 mL. Following steps 2-6, apply the developer colour.

Calculation:

The graph was used to draw a standard curve and compute the tryptophan percentage in the sample. Using the following calculation, I calculated the tryptophan content in the sample as g/100g protein.

$$\text{Tryptophan content (g/100g protein)} = \frac{\text{Tryptophan percent in the sample}}{\text{protein \% in sample}} \times 100$$

(This formula should be written in "Microsoft Equation 3" format and is better to assign an equation number)

The AOAC technique was used to determine the moisture content of the mustard sample (9).

Methods of Data Analysis??

RESULT AND DISCUSSION

The following section describes the experimental findings on the processing, physical, and nutritional aspects of chickpea varieties:

Moisture content of different mungbean types ranged from 0.38 to 5.68 percent represented in the Table 1. Variation KM-2364 had a higher moisture content than variety KM-2268, which had a lower moisture content. Various researchers have obtained similar results, such as PAUL *et al.*, 2011 who reported a moisture content of 3.85. The moisture content range was 4.86-6.16 percent, according to ANWAR *et al.*,(2007).

Maturity period- Table 1 shows data on mungbean maturity periods impacted by different varieties of mungbean. Maturity periods of mungbean with different kinds ranged from 60 to 70 days. KM-2272 has the longest maturity duration, followed by K-851, IPM-02-3, and KM-2348 (68 days). In KM-2241, the minimum maturity period was documented (60 days).

No. Of pod per plant- Data on the number of pods per plant of mungbean shown in Table-1 as influenced by different mungbean types revealed that the number of pods per plant was strongly influenced by different mungbean variations. Variety KM-2364 had a significantly greater number of pods per plant (27 pods/plant), and IPM-02-3 had a significantly higher number of pods per plant (27 pods/plant) than the other varieties, however PDM -11 had the lowest number of pods per plant (18 pods/plant).The maximum range of variability was observed for number of pods per plant (12.22 - 20.55) by Rahim *et al* 2010.

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Yield g/plant: A review of the data in Table 1 on mungbean grain yield (g/plant) as influenced by different varieties revealed that the KM-2364 had a significantly higher grain yield (5.94 g/plant) than the rest of the mungbean varieties, and the lowest grain yield (2.90 g/plant) was obtained in variety T-44.

Methionine content variability in dhal sample of mungbean varieties- Table 2 shows the results of the dhal sample in terms of methionine content, which is visually depicted in fig 2. Data analysis found that the methionine level of dhal samples from potential mungbean types ranged from 0.35-0.72 g/16g N. The cultivars KM-2260 and KM-2328 were found to have the highest methionine content. PDM-11 has significantly lower methionine levels than the other mungbean cultivars and genotypes.According to Dahiya*et al.*,2015, methionine content in mungbean ranged from 1.02-1.28g/16g N. Methionine content ranged from 0.93-1.35g/16g N accordingto Pandey*et al.*, 2022.

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Tryptophan content variability in mungbean varieties in which Table-2 shows the results of the dhal sample in terms of tryptophan content, which is visually depicted in fig. 2. According to the data, the tryptophan level of dhal samples from promising mungbean cultivars ranged from 1.30-1.80 g/16g N. In comparison to the other types, variation KM-2362 has a significantly greater tryptophan concentration in dhal. The tryptophan level of the mungbean cultivar KM-2364 was lower (1.30g/16gN). Mungbean seeds have a mean tryptophan concentration of 1.2g/16g N, according to Dahiya *et al.*(2015). According to Aparna*et al.*(2007), tryptophan content ranged from 0.60-1.08 g/16g N.According toPandey *et al.*(2022), tryptophan content ranged from 0.76-1.12g/16g N.

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CONCLUSION

Based on the findings of this study, it can be stated that out of the 20 mungbean genotypes/varieties studied, KM-2260 had the highest methionine level and KM-2362 had the highest tryptophan content in dhal. The genotype/variety IPM-02-3 produced the most pods per plant. The maximum grain production per plant was KM-2364, the lowest moisture content was KM-2268, and the shortest maturity period was KM-2320. The genotype/variety KM-2328 is superior in terms of maximum number of pods per plant, maturity period, tryptophan, and methionine content.

Recommendation????

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APPENDICES??

Table1. Biochemical Changes in Relation to Nutritional Quality inMungbean Genotypes (*Vignaradiata* (L.) R. Wilczek) on Physical characteristics.

Sr.no.	Varieties/genotypes	Moisture (%)	Maturity period (days)	no. of pod per plant	Yield g/plant
1.	T-44	1.23	67	21	3.65

2.	K-851	1.93	68	23	4.67
3.	KM-2241	1.77	60	24	4.85
4.	KM-2195	1.05	65	20	3.60
5.	KM-2328	4.92	60	21	3.80
6.	PDM-139	2.04	60	19	3.20
7.	PDM-11	2.30	65	18	3.00
8.	IPM-02-3	1.71	68	27	5.84
9.	IPM-205-7	1.82	60	24	4.60
10.	KM-2252	2.05	65	25	5.30
11.	KM-2260	1.66	60	21	3.75
12.	KM-2268	0.38	62	23	4.50
13.	KM-2272	2.94	70	18	2.90
14.	KM-2280	1.28	65	20	3.50
15.	KM-2320	3.34	60	26	5.68
16.	KM-2342	2.20	65	23	4.40
17.	KM-2348	2.75	68	21	3.80
18.	KM-2355	2.36	62	24	4.90
19.	KM-2362	0.90	66	22	4.10
20.	KM-2364	5.68	65	27	5.94
	Mean	2.21	64.05	22.35	4.29
	C.D. at 5 %	0.15	3.83	1.34	0.26

TABLE 2- Biochemical Changes in Relation to Nutritional Quality inMungbean Genotypes (*Vignaradiata* (L.) R. Wilczek) on Nutritional characteristics

Sr. no.	Varieties/genotypes	Dhal methionine (g/16gN)	Dhal tryptophan (g/16gN)
1.	T-44	0.45	1.53
2.	K-851	0.58	1.42
3.	KM-2241	0.60	1.61
4.	KM-2195	0.45	1.66
5.	KM-2328	0.70	1.69
6.	PDM-139	0.44	1.70
7.	PDM-11	0.35	1.71

8.	IPM-02-3	0.53	1.77
9.	IPM-205-7	0.48	1.70
10.	KM-2252	0.65	1.54
11.	KM-2260	0.72	1.67
12.	KM-2268	0.55	1.78
13.	KM-2272	0.43	1.74
14.	KM-2280	0.41	1.62
15.	KM-2320	0.38	1.77
16.	KM-2342	0.51	1.62
17.	KM-2348	0.62	1.69
18.	KM-2355	0.47	1.53
19.	KM-2362	0.53	1.80
20.	KM-2364	0.58	1.30
	Mean	0.52	1.64
	C.D at 5 %	0.03	0.09

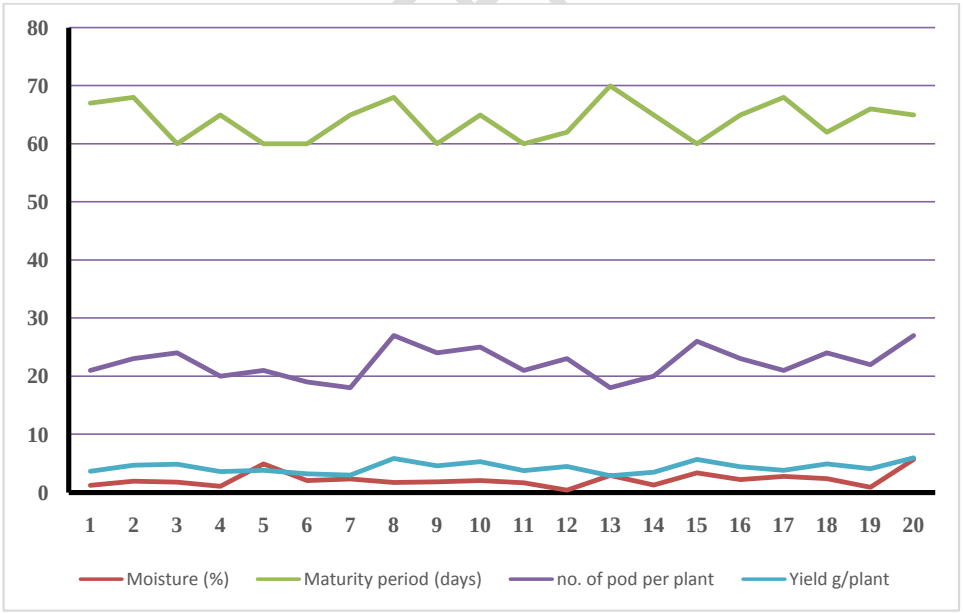

Figure.1.Showing Biochemical Changes in Relation to Physical characteristics in Mungbean Genotypes (*Vignaradiata* (L.) R. Wilczek).

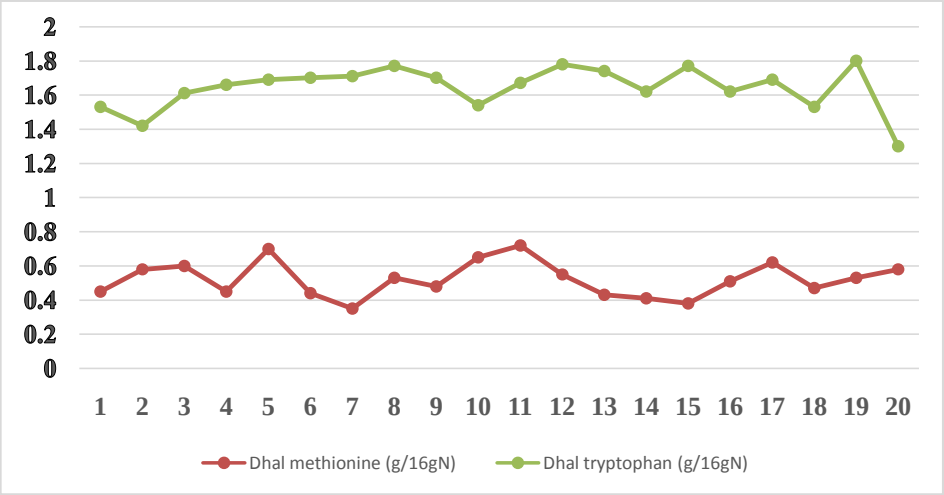

Figure.2.Showing Biochemical Changes in Relation to Nutritional Quality in Mungbean Genotypes (*Vignaradiata* (L.) R. Wilczek).