*Himachal Journal of Agricultural Research 33 (2):232-235, 2007*

# Effect of germination and drying temperatures on the enzymes and antinutritional activity of soybean flour

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**Abstract**

**Germination is believed to have a positive effect on the nutritional quality of grains. An attempt was made to assess the effect of germination on the enzyme and antinutritional activity of soybean flour. Two varieties of soybean viz. Shivalik and Punjab No.1 were allowed to germinate for 36 and 48 hrs at room temperature followed by drying of the grains at room temperature and 70±5$^0$C with the help of tray drier. The dried grains were milled to flour fineness. A significant increase in the enzyme activity was observed with germination of soybean. The mean values of diastase and protease activities were 130.48 and 139.82 of ungerminated soybean which increased to 272.03 (mg maltose/ 10g) and 355.95 (mg protein hydrolysed/100g) after 48 hrs of germination respectively. However, the lipase activity was higher in flour obtained from 36 hrs germinated soybean grains. A significant decrease in the trypsin inhibitor activity was observed with increase in germination time. The drying temperatures also had a significant effect on these parameters.**

**Key words:** Soybeans, germination, drying, enzymes and trypsin inhibitor.

## Introduction

Soybean is potentially an important source of protein as it grows well in certain parts of North India. It contains as high as 40 to 45 per cent protein and its amino acid profile approaches the optimum pattern as recommended by FAO (Ferrior, 1976). Soybean is a legume increasingly consumed for economical and nutritional reasons (Henky *et al.*, 1993 and Garcia *et al.*, 1997). The chemical and nutritional value of soybean seeds can be improved by a process called germination. Germination process has been developed in some countries to overcome some of the disadvantages associated with ungerminated soybeans such as undesirable flavour and odour and the presence of trypsin inhibitors (McKinney *et al.*, 1958; Suberbie *et al.*, 1981 and Vanderstoep 1981). Germination improves the nutritional value of the proteins which are hydrolysed into easily assimilable polypeptides and essential amino acids and decrease trypsin inhibitors.

## Material and Methods

The samples of soybean varieties (Shivalik and Punjab No.-1) were procured from the Department of Plant Breeding and Genetics, CSK Himachal Pradesh Krishi Vishvavidyalaya Palampur. After thorough cleaning, the samples were kept in metallic bins for further use.

**Germination of Soybean seeds:**Germination of the samples was done after soaking the mature, unbroken, washed soybean seeds in tap water (1:5) for 6-8 hours at room temperature. The soaked seeds were washed thoroughly and the whole sample was divided into four lots and given various treatments as shown in Fig. 1.

**Chemical analysis:**The diastase activity was determined by using Bush and Sandstede method as described in AACC (1976) whereas the protease activity was determined by Arye and Anderson method of AACC (1976) with a modification that instead of determining the soluble nitrogen, protein was determined by the method of Lowery *et al.* (1951) using Bovine Serum Albumin (BSA) as reference. The lipase activity was expressed as percent oleic acid on fat basis using AACC (1976) quick method for free fatty acids. The activity of enzyme trypsin was assayed by using casein as substrate and

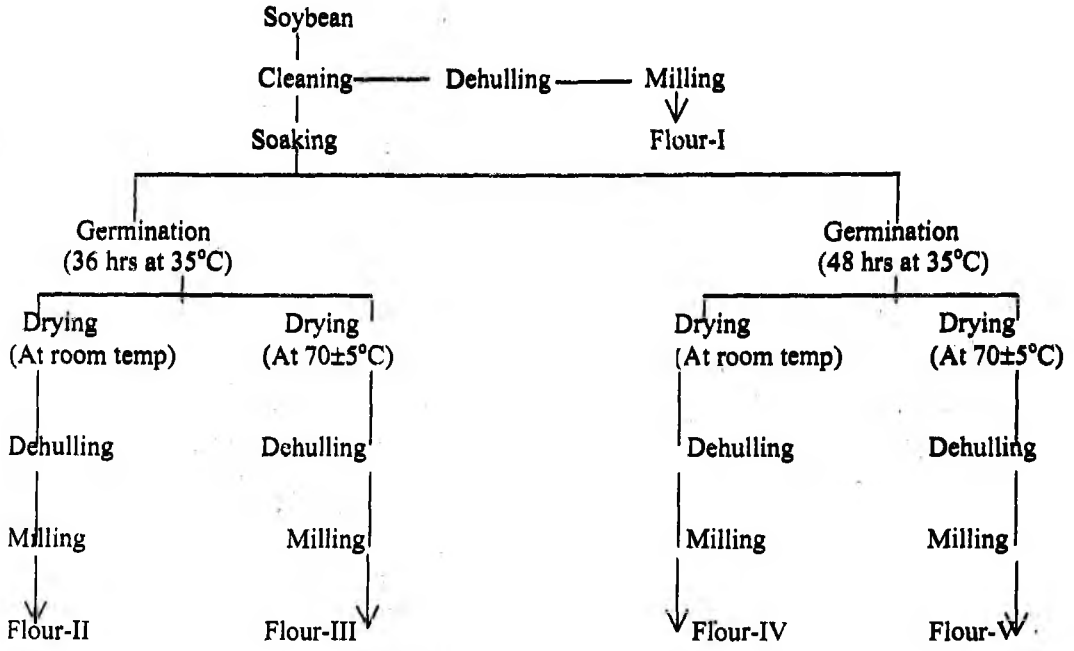



**Fig-1 Flow chart for the preparation of soybean flours**

inhibition of this activity was measured in the extract using method given in NIN (1983).

## Results and Discussion

The effect of germination time on the diastase, protease and lipase activities of soybean flour is presented in Table 1. The enzyme activity varied significantly with respect to germination time. The higher diastase activity in the flour obtained from germination might be due to the development of alpha amylase during germination. A similar increase in diastatic activity in sprouted cereals was observed by Pomerang and Robbins (1971). The protease activity also increased with increase in germination time. Gasztonyi *et al.* (1972) and Hwang and Bushuk (1973) also rported that germination/sprouting of wheat increased the proteolytic activity A similar increase in the proteolytic activity was observed by The diastase and protease activities in control samples were 130.48 mg maltose /10 g and 139.82mg protein hydrolysed/100g which increased to 272.03 mg maltose and 355.52 mg protein hydrolysed/100g flour respectively after 48 hours of germination. However, in case of lipase activity which increased with germination up to 36 hours and after that a decrease in the lipase activity was recorded. Germination also had a significant effect on trypsin inhibitor activity which decreased with increase in germination time. Similar findings were reported by Deshpande and Cheryan (1983) and Mostafa *et al.* (1987). The decrease in trypsin inhibitor activity due to germination process could be attributed to the leaching out of some elements during daily washing of the sprouts, such elements being involved in the mechanism of the trypsin inhibitor.

**Table 1. Mean values of enzymes and trypsin inhibitor activity of soybean flour as affected by germination**

| Parameter (s) | Germination time (hrs) | | | | |
|---|---|---|---|---|---|
| | 0 | 36 | 48 | Mean | CD (P≤0.05) |
| Diastase(mg maltose/10g flour) | 130.48 | 202.55 | 272.03 | 201.69 | 7.11 |
| Protease (mg protein hydrolysed /100g flour) | 139.82 | 325.49 | 355.95 | 273.75 | 22.24 |
| Lipase (% fat activity) | 0.27 | 0.79 | 0.35 | 0.47 | 0.04 |
| Trypsin inhibitor (TIU/g flour) | 95.50 | 59.33 | 55.79 | 70.20 | 1.05 |

Table 2 indicates the effect of drying temperatures on the enzyme and trypsin inhibitor activity of the soybean flour. A significant effect of drying was observed on diastase, protease and lipase activity of the germinated samples. The samples dried at higher temperatures had lesser diastase, protease and lipase activity as compared to the samples dried at room temperature. The mean values for diastase activity of samples dried at low and high temperatures were 274.12 and 200.47 mg maltose/10g flour respectively. This reduction in the activity may be due to partial inactivation of enzymes during drying at high temperature. Similarly the drying temperatures also affected the trypsin activity of the samples significantly. The higher mean values were observed in samples dried at low temperatures whereas these values were lower in samples dried at higher temperature. This could be attributable to the reason of using higher temperatures during drying.

Effect of different varieties (Shivalik and Punjab No. 1) on the enzymes and trypsin inhibitor activity of the soybean flour is presented in Table 3. As is evident from the table the varieties also differed significantly with respect to enzyme and trypsin inhibitor activity. Shivalik variety had higher mean values for protease activity whereas higher mean values for diastase activity were recorded for variety Punjab No.1. Similarly, the varieties also differed significantly for trypsin inhibitor activity and higher mean value was noticed in variety Shivalik (70.82 TIU/g) as compared to variety Punjab no-1 (69.59 TIU/g). This could be attributable to varietals differences.

**Table 2. Mean values of enzymes and trypsin inhibitor activity of soybean flour as affected by drying**

| Parameter (s) | Drying temperatures | | | |
|---|---|---|---|---|
| | Low* | High** | Mean | CD (P≤0.05) |
| Diastase(mg maltose/10g flour) | 274.12 | 200.47 | 237.29 | 5.60 |
| Protease (mg protein hydrolysed /100g flour) | 376.00 | 305.42 | 340.72 | 17.50 |
| Lipase (% fat activity on fat basis) | 0.74 | 0.42 | 0.58 | 0.03 |
| Trypsin inhibitor (TIU/g flour) | 65.56 | 49.57 | 57.56 | 0.02 |

*Room Temperature, ** 70±5°C

**Table 3. Enzymes and trypsin inhibitor activity of soybean flour as affected by varieties**

| Parameter (s) | Varieties | | | |
|---|---|---|---|---|
| | Shivalik | Punjab No. 1 | Mean | CD (P≤0.05) |
| Diastase(mg maltose/10g flour) | 178.70 | 224.46 | 201.69 | 5.60 |
| Protease (mg protein hydrolysed /100g flour) | 323.18 | 224.46 | 273.75 | 17.50 |
| Lipase (% fat activity on fat basis) | 0.36 | 0.57 | 0.47 | 0.03 |
| Trypsin inhibitor (TIU/g flour) | 70.82 | 69.59 | 70.20 | 0.02 |

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