4.2 EFFECT OF DEHULLING ON THE COOKING TIME AND PROTEIN QUALITY OF THE HARD-TO-COOK BEANS.

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EFFECT OF DEHULLING ON THE COOKING TIME AND PROTEIN QUALITY
OF THE HARD-TO-COOK BEANS

Previous results in this subject are as following: a) A dry and a wet dehulling process has been developed, giving similar yield of dehulled beans (see Figure 1); b) dehulling significantly reduced cooking time as compared with beans with seedcoat; dry method gave the best results as far as the cooking time is concerned; d) dehulling process also drastically decreased tannin content (as catechin equivalents) and increased protein quality and digestibility; d) an association has been found between tannin content and protein digestibility (see Table 1); e) in summary it can be concluded that the dehulling process decreases cooking time and improves significantly protein value of beans.

Processing Technology and Utilization of Dehulled Beans

From the results previously discussed, dehulled beans have technological and nutritional characteristics which offer interesting possibilities of uses in the preparation of different food products. One atractive possibility is the preparation of precooked bean flour which can be further utilized in the formulation of soups, fried beans, high protein foods and infant foods.

Processes used for the Preparation of precooked dehulled bean flours were as following: extrusion-cooking, atmospheric cooking, drum-drying and toasting. For the extrusion-cooking process a Brady Crop Cooker extruder, model 2160 (Brady, Division of Koering Co., Appleton, W.) was used.

A flow diagram and the conditions of operation for the four processes used in the preparation of the dehulled and precooked bean flours are shown in Figure 2.

Each one of the final products was analyzed for their nutritional and functional properties. Table 2 shows the amount of selected nutrients in the cooked flours as compared with the raw whole bean and dehulled flours. Among the four cooked flours, extrusion-cooking seems to have the most favorable composition in terms of available lysine and antinutritional factors. Functional properties (Table 3) in terms of water solubility index (WSI) and percentage of dispersability also confirmed the benefitial effects of the extrusion-cooking process over the others. Water absorption index (WAl) showed very similar values. Biological evaluation of protein quality and sensory analysis of these cooked flours are now underway. Further studies on this subject will be related to the formulation of an infant food based on soybean, corn and a bean flour selected from the above processes.

TABLE 1

TANNIN CONTENT AS CATECHIN EQUIVALENTS (mg/g)' AND, TRUE DIGESTIBILITY
IN WHOLE AND DEHULLED BEANS*

Dehulling Process	Fresh Beans**		Hardened Beans***	
	Tannin (mg/g)	Digestibility	Tannin (mg/g)	Digestibility
Dry Process	0.71	75.0 ± 2.8	0.00	75.0 ± 2.7
Wet Process	0.13	83.5 ± 1.7	0.78	76.9 ± 2.4
With seed coat	8.56	69.0 ± 3.3	5.33	67.9 ± 2.6
Casein		94.1 ± 0.6		

* Beans cooked at 16 lbs. pressure and 121°C for 25 minutes.

** Tamazulapa variety.

*** National 1981.

TABLE 2

NUTRITIONAL PROPERTIES OF BEAN FLOURS MADE FROM HARD-TO-COOK BEANS DEHULLED AND PROCESSED BY DIFFERENT COOKING METHODS

Nutritional Characteristics	RAW		Extrusion	Drum Drying	Open Kettle	Toasted
	With hull	Dehulled				
Protein (g/100 g)	21.9	22.0	23.6	23.6	23.8	24.9
Trypsin inhibitors (UTI/ml)	9.5	7.0	1.9	9.0	2.2	9.0
Hemagglutinin (activity)	+8	+9	+4	+8	+4	+7
Available lysine (g/.16 g N)	5.5	6.4	5.7	·4.6	4.9	6.0

TABLE 3

FUNCTIONAL PROPERTIES OF BEAN FLOURS MADE FROM HARD-TO-COOK BEANS DEHULLED AND PROCESSED BY DIFFERENT COOKING METHODS

Physical Properties	RAW BEANS		COOKING PROCESS			
	With hull	Dehulled	Extrusion	Drum Drying	Open Kettle	Toasting
Water absorption index (WAI)	2.90	2.49	4.35	5.72	3.51	2.64
Water solubility index (WSI)	11.28	8.26	14.83	11.51	2.83	10.96
% dispersability*	35.25	26.75	80.25	73.75	41.0	34.25

* Stability of a 10% suspension stirred for 5 minutes and then allowed to settle for 30 minutes in a graduated cylinder of 100 ml.

FIGURE 1

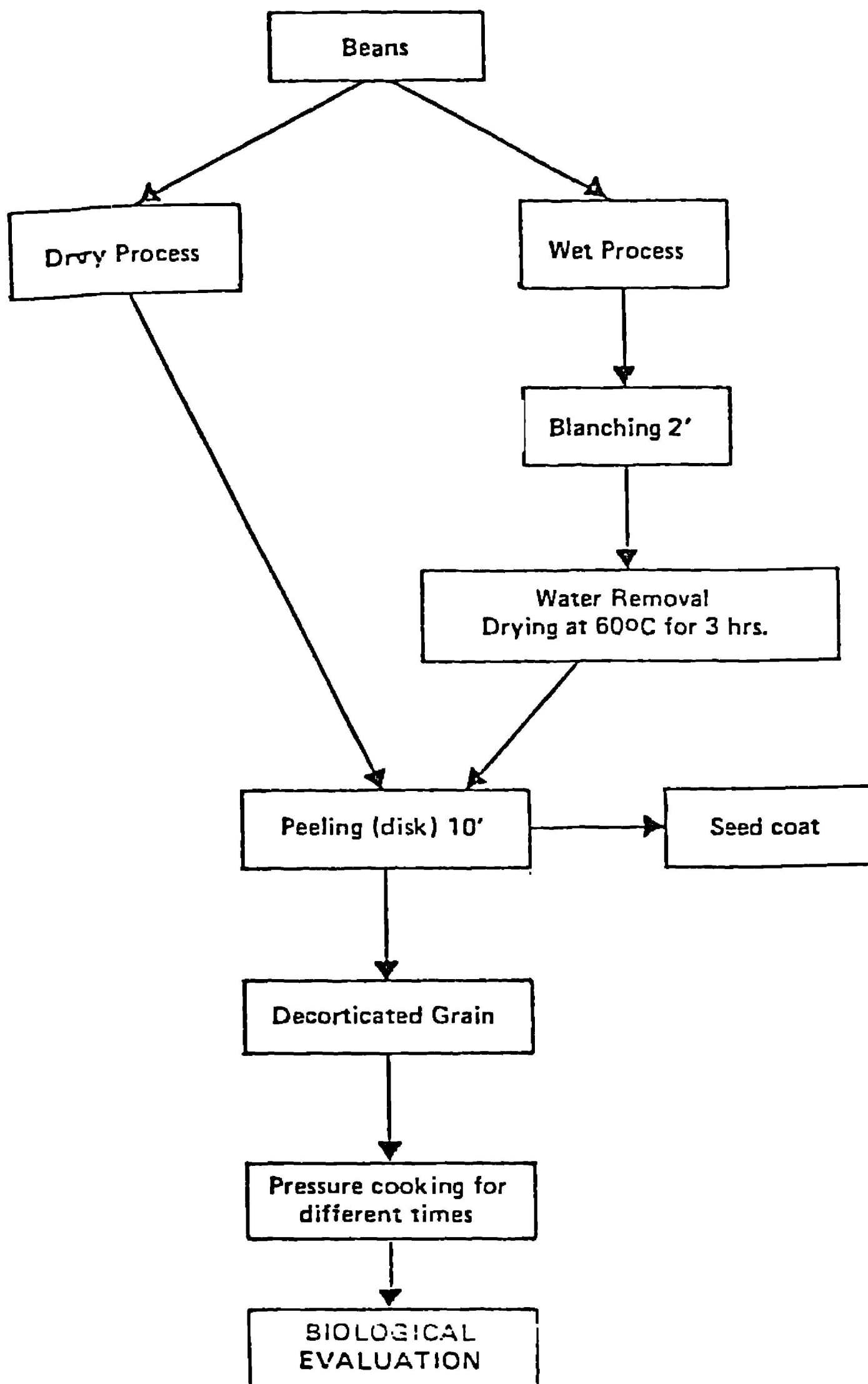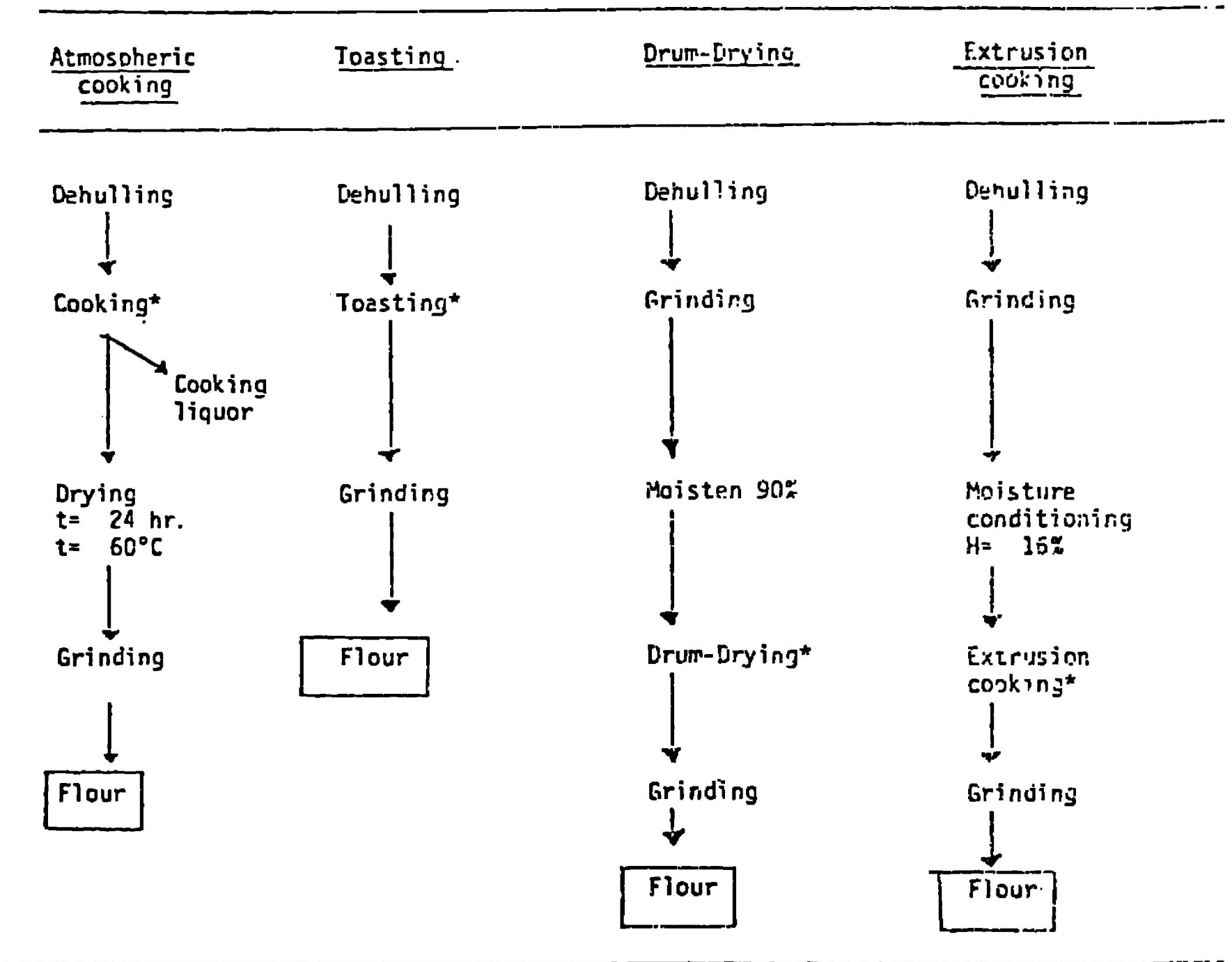## FLOW DIAGRAM OF DECORTICATION PROCESS

FIGURE 2

FLOW DIAGRAM AND CONDITIONS FOR THE PROCESSES USED FOR THE
PREPARATION OF DEHULLED PRECOOKED BEAN FLOURS

Atmospheric cooking	Toasting	Drum-Drying	Extrusion cooking
Dehulling	Dehulling	Dehulling	Dehulling
↓	↓	↓	↓
Cooking*	Toasting*	Grinding	Grinding
→ Cooking liquor			
↓	↓	↓	↓
Drying t= 24 hr. t= 60°C	Grinding	Moisten 90%	Moisture conditioning H= 16%
↓	↓	↓	↓
Grinding	Flour	Drum-Drying*	Extrusion cooking*
↓		↓	↓
Flour		Grinding	Grinding
		↓	↓
		Flour	Flour

* T= 121°C * T= 130°C * T= 143°C Cone opening= 0 09

P= 15 psi.   H= 13%   v= 2 rpm   H= 16%

t= 10 min.   t= 15 min.   P= 60 psi.