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Whole soybeans for dairy cattle

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Whole soybeans (WSB) can be used in dairy cow rations; they are palatable and have excellent feed value. WSB have lower protein content than soybean meal but because of higher fat, have higher net energy content (See Table 1).

How much WSB should I feed?

You can feed limited amounts of WSB. We generally consider the maximum to be 6-7 lbs./day or up to 20 percent of the concentrate. The amount depends upon other feed ingredients in the ration and their fat content. (See Table 2.)

Some examples are:

Ration 1

20 lb. corn
7 lb. WSB

Ration 2

3 lb. whole cottonseed
20 lb. corn
5 WSB

Ration 3

10 lb. corn
10 lb. distillers grains
5 lb. WSB

Ration 4

25 lb. milo
7 lb. WSB

The point is that the other ingredients add fat to the diet and this must be taken into account. The more fat there is in the other grains, the less WSB you should feed.

How much fat can I allow?

Most research indicates that if the total diet contains more than about 5 percent fat, digestibility, milk yield and milk composition may decline. For the average cow eating 40-50 lbs. of DM daily, 5 percent fat amounts to 2-2.5 lbs. of fat (See Table 2).

Table 1. Comparison of whole soybeans to soybean meal

	As fed basis	
	WSB	Soybean meal
Protein, %	39	44
ADF, %	9	10
NDF, %	10	12
Crude Fiber, %	6	6
Fat, %	18	1.4
Ca, %	.28	.36
P, %	.66	.75
Net Energy Mcal/lb	.88	.79

Table 2. Fat content of feeds (dry basis)

Feeds	% Fat
Barley	4.3
Corn	2.3
Whole cottonseed	25.0
Dried distiller grains	9.4
Hominy	8.3
Milo	3.2
Oats	4.4
Whole SB	20.0
SB meal	1.4
Wheat	2.0
Alfalfa hay	2.0
Corn silage	1.0

What if fat content is too high?

Too much fat may often depress digestibility, particularly that of fiber. This may be because fatty acids, hydrolyzed from fat in the rumen, attach to bacteria and inhibit their action. This effect, however, is minimized by increased calcium and magnesium in the diet.

Table 3. Effect of feeding diets varying in fat percent (Ohio State study)

	Experiment 1			Experiment 2	
Diet	**11**	**12**	**13**	**21**	**22**
Protein, %	16.6	17.5	17.5	15.9	16.3
ADF, %	18.2	18.5	19.7	19.3	21.3
Fat, %	3.2	5.7	10.8	2.9	6.8
Calcium, %	.7	.8	.8	.6	6.8
Concentrate, % diet	42	42	42	50	33
Digestibility, %					
DM	62.5	67.3	66.7	63.1	59.3
ADF	35.6	44.3	44.0	31.3	35.3
Protein	64.0	67.6	70.6	63.7	66.7
DMI lb./day	44.4	46.6	40.4	42.5	44.4
FCM lb./day	62.3	66.7	59.8	53.2	60.9
Milk fat, %	3.51	3.42	3.25	2.71	3.44
Milk protein, %	3.06	3.04	3.12	3.38	3.23

In a study at Ohio State, researchers fed cows diets containing various proportions of corn, oats, wheat bran, soybean meal, alfalfa meal, corn silage and alfalfa pellets. Fat percent in the diet varied from 3.2 percent to 10.8 percent. The data are summarized in Table 3.

In this study, increasing dietary fat had little effect on intake. Milk yield (FCM) was highest for the 5.7 percent fat group; milk fat percent decreased as fat increased. Digestibility was increased in the 5.1 percent fat diet (diet 12) but not in the 10.8 percent fat diet (diet 13). Milk protein percent, sometimes depressed by high dietary fat, was unaffected in this study. Milk fat percent was lower in diet 21, probably because more concentrate was fed.

WSB feeding studies

WSB were fed to lactating cows in several studies. They are summarized in Tables 4 and 5.

These studies suggest that reasonable amounts of WSB don't cause detrimental effects and can be substituted in typical diets. Some other concerns and considerations are:

1. WSB contain urease. If they are mixed with diets containing urea, ammonia will form, decreasing palatability.

2. Calcium and magnesium concentrations should be higher than in conventional diets, because both form insoluble complexes with fat.

4. WSB can be used beneficially in high grain rations to reduce starch intake.

5. Ensiling is a good method of storing and handling WSB, especially in a wet year. Preservatives (propionic acid) may be another option.

6. WSB may be ground prior to feeding. Grinding appears to offer no nutritional advantage but may improve handling characteristics. Ground WSB will become rancid if allowed to stand too long; don't process more than 10 days worth at a time. Vitamins including vitamin E should be added.

7. Balance diets carefully when using WSB to meet protein and energy requirements.

8. Increased fat for high producers in early lacta-

Table 4. Feeding whole soybeans to dairy cows (Wisconsin-Marshfield study)

	Ensiled shelled corn + dry WSB	Ensiled ear corn + ensiled WSB	Dry conventional Concentrate
Concentrate, lb. DM/day	9.8	11.0	9.2
Forage[a], lb. DM/day	23.6	23.8	25.4
FCM, lb./day	39.9	40.1	38.5
Milk fat, %	4.11	4.16	4.23
Number of cows	17	17	17

[a]Legume—grass haylage and corn silage.

Table 5. Feeding whole soybeans to dairy cows (California study)

			Whole cotton seed	
	Control	**WSB**	**15%[a]**	**30%[a]**
DMI, lb./day	41.4	42.8	40.7	42.0
Test feed[b], lb./day	—	3.4	6.8	14.0
Milk, lb./day	71	77	67	70
Milk fat, %	3.7	3.74	4.0	4.18
Milk protein, %	3.14	3.06	2.99	3.01

[a]% of diet
[b]WSB, 15% WCS or 30% WCS

tion may reduce the incidence of ketosis, because fat contributes energy directly to meet metabolic needs. Because fat is high in energy density (2.25 x carbohydrate), this contribution can be significant. Substituting 1 lb. fat for 1 lb. of starch increases net energy by 1.3 Mcal/day.

9. Blending WSB into a TMR along with forage and concentrates is a good feeding strategy.

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