Dissemination of Weed Seeds through Cow Feces

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As upland farmers have differentiated into dairy farmers and vegetable growers in recent years, the lack of organic matter in vegetable growers and the disposal of excess livestock feces in dairy farmers have become serious problems. As a means of solving these problems, a system for circulation and utilization of livestock feces through the combination between dairy farmers and vegetable growers has been promoted. But, there are many unsettled problems in the utilization. One of the unsettled problems is the dissemination of weed seeds through livestock feces.

This investigation was carried out from 1973 to 1976.

Viability of weed seeds passed through digestive tract of dairy cow

The purpose of this experiment was to determine whether or not the spreading of feces over fields causes weed infestation, especially when feeds containing large quantities of weed seeds were fed.

1) Number of viable weed seeds in raw feces

Method: A Holstein heifer was fed 50,000 seeds each of livid amaranth (*Amaranthus lividus* L.), large crab-grass (*Digitaria adscendens* Henr.) and Italian ryegrass with 1 kg of concentrate on 10, September 1973. Feces defecated by the cow were collected for 5 days after the feeding. Samples of 10% amount of the feces were washed through a series of sieves. The washed samples were then dried and tested for germination.

Results:

The total number of seeds germinated per samples taken in 5 successive days (10% of feces, and hence containing 5,000 seeds) was 2,635 for livid amaranth, 1,290 for large crab-grass and 1,523 for Italian ryegrass. The germination ratio to original germination was 64% in livid amaranth, and 32% in large crab-grass and Italian ryegrass, respectively.

Number of seeds germinated from each sample was the most with the sample of second day after feeding and the least with the sample of fifth day after feeding (Table 1).

2) Germination percentage of seeds stored in manure tank

Method: Fresh seeds of livid amaranth,

Table 1. Number of weed seeds germinated after the passage through the digestive tract of cow

Species	Days after feeding						Germination*	Germination ratio** to original germination
	1	2	3	4	5	total		
Livid amaranth	81	976	883	603	92	2,635	53%	64%
Large crab-grass	118	884	251	37	0	1,290	26	32
Italian ryegrass	132	1,248	139	3	1	1,523	31	32

* Germination: percentage to 5,000 seeds
Original germination: livid amaranth 83%, large crab-grass 82%, Italian ryegrass 96%

** $\text{Germination ratio to original germination} = \frac{\text{number of seeds germinated per 10\% feces}}{5,000 \times \text{original germination (\%)}} \times 100$

large crab-grass and Italian ryegrass were enclosed in the nylon-mesh bags and stored in manure tank on 4 October, 1973. The seeds were recovered after 1 and 3 months, and tested for germination.

Results:

Viability of livid amaranth seeds was little affected by the storage in manure tank for 1 or 3 months, but that of large crab-grass was apparently reduced. Italian ryegrass seeds lost viability mostly by the storage for 1 month and lost it completely after 3 months (Table 2).

Table 2. Germination percentage of weed seeds stored in manure tank

Species	Storage duration (month) 1	3	Original
Livid amaranth	95%	91%	94%
Large crab-grass	80	22	91
Italian ryegrass	2	0	89

3) Weeds in grass fields

Method: Yields (grass + weed) and number of weed seeds were measured at the first mowing in liquid manure plots (Italian ryegrass and rhodes grass had been continuously cultivated for 9 years with the application of liquid manure every year) and compound fertilizer plots (the cropping system was the same as above but no liquid manure was applied) in 1973.

Results:

Weed yields were more than grass yields at the first mowing of rhodes grass, both in liquid manure plots and in compound fertilizer plots. Livid amaranth accounted for 86% of yields in the liquid manure plots, and large crab-grass 66% in the compound fertilizer plots. Such a large number of livid amaranth seeds as 65,000 seeds/m^2 observed at the first mowing in the liquid manure plots indicated the accumulation of the seeds which survived in the digestive organ of cow and in the manure tank. On the contrary, many large crab-grass seeds were observed at the second mowing of rhodes grass in the compound fertilizer plots.

The results of these experiment indicated that the spreading of feces over fields caused weed infestation, especially of livid amaranth.

Methods of killing weed seeds in livestock feces and feeds

1) Drying and fermenting of cow feces

Method: Nine kinds of weed seeds were enclosed in the nylon-mesh bags and stored in piled feces fermenting. The seeds were placed into the upper zone and central zone of the piled feces on 21 May and on the surface of the pile on 23 July, 1973.

Results:

All the seeds stored in the upper zone and the central zone lost their viability. But, all the seeds placed on the surface of piled feces maintained their viability. It shows that the turn-over and remixing of piled feces are needed to kill all seeds contained in livestock feces (Fig. 1 and Table 3).

2) Ensilage

Method: Seeds of two main weeds were enclosed in the nylon-mesh bags and stored with forage in stack silos on 9 August, 1974 under high temperature fermentation, on 17 April, 1975 under low temperature fermentation, and on 16 April, 1976 for a long period storage under low temperature. They were taken out after 60 days of storage, except the long period storage which lasted for 160 days, and tested for germination.

Results:

Under the high temperature fermentation, only a few weed seeds were viable at low water-content condition, but all the weed seeds stored at moderate or high water-content condition lost viability. On the other hand, under the low temperature fermentation, the storage at low water-content condition affected the viability only slightly, but at high water-content condition most of the seeds were killed. The elongation of storage period (100 days in addition to 60 days) was very effective in killing weed seeds (Table 4).

Table 3. Germination percentage of weed seeds stored in piled feces

Species	Storage in piled feces			Control
	Surface	Upper	Center	
Large crab-grass	96%	0%	0%	74%
Barnyard grass	72	0	0	87
Chufa	56	0	0	30
Common lambsqarters	26	0	0	16
Polygonum lapathifolium	8	0	0	53
Common purslane	85	0	0	91
Livid amaranth	68	0	0	70
Virginia copperleaf	7	0	0	51
Fatoua villosa	26	0	0	19
Upland rice	75	0	0	98
Barley	16	0	0	96

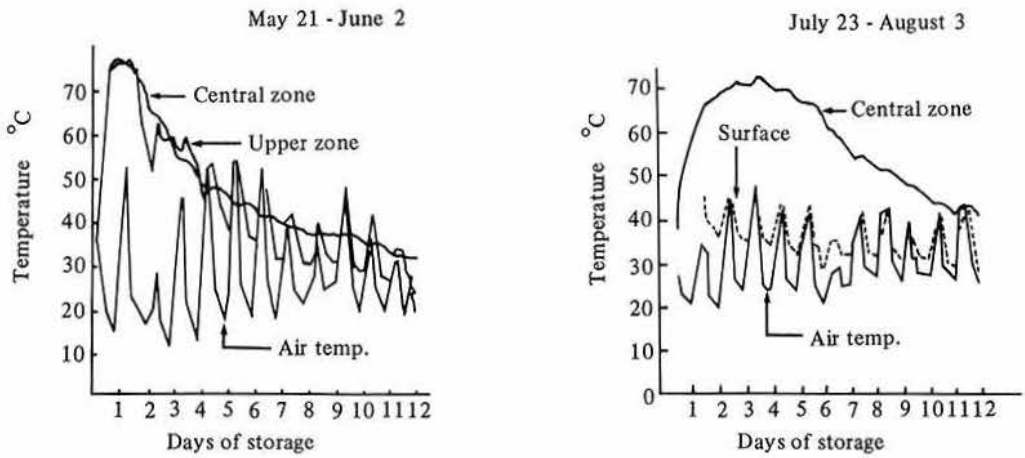


Fig. 1. Temperature of fermenting feces and greenhouse air temperature

Table 4. Germination percentage of weed seeds stored in stack silo

Water content condition	Species	Germination (%)		
		High temp.	Low temp.	Low temp.*
High	livid amaranth	0	6	0.5
	large crab-grass	0	0	0
Moderate	livid amaranth	0	62	—
	large crab-grass	0	0	—
Low	livid amaranth	5	95	0
	large crab-grass	0	77	0

* long period

3) Drying of green forage by high temperature wind

Method: Green forage containing large quantities of such weed seeds as livid amaranth, large crab-grass and barnyard grass was dried from 80% of water content to 15% by very high temperature wind (about 700°C) in a rotary-type dryer for a few minutes on 13 September, 1976. The weed seeds were taken out from the dried forage and tested for germination.

Results:

The weed seeds taken out from the dried forage were found perfectly killed.

Dissemination of weed seeds by purchased feeds and grass seeds

1) Germination of weed seeds contained in wafers

Method: Experiment 1: Weed seeds contained in wafers for sale were tested for germination. Experiment 2: Two kinds of wafers were produced from the grass containing seeds of livid amaranth and large crabgrass under different pressures, that is, 160–210, 280–370 kg/cm^2 by a wafering machine.

Results:

In the experiment 1, Graminaceous and Compositae plant seeds were detected from a sample out of six samples. In the experiment 2, the weed seeds were not completely killed by pressure of 160–210 kg/cm^2, but were devitarized perfectly by pressure of 280–370 kg/cm^2. This result indicates that wafers produced by pressure of about 200 kg/cm^2 would contain viable weed seeds.

2) Germination of weed seeds contained in feeds for sale without wafering

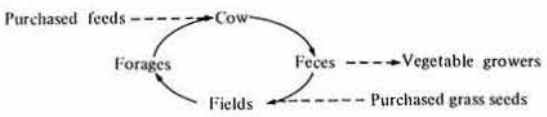
It is apparent that roughages for sale which are not waferred may contain viable weed seeds, because any treatment to kill weed seeds has not been made.

Some samples of concentrate were found to contain viable seeds of tall weeds such as barnyard grass.

3) Weed seeds contained in purchased grass seeds

Many researchers reported that grass seeds contained a lot of weed seeds. The present authors also found large quantities of weed seeds in purchased grass seeds.

Based on the above results, the following routes of dissemination of weed seeds was confirmed.



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