Cooperative Extension
Colorado State University, Fort Collins, Colorado 80523

Colorado State University

AGRON-GRAM

April 1991

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FREEZE DAMAGE TO WHEAT

Just prior to Christmas in 1990, -30°F temperatures occurred in various parts of eastern Colorado. Most areas had little or no snow cover, thus exposing the crowns of the winter wheat plants to the full impact of the cold. Because of the extreme cold and no snow cover, the top growth died back, leaving very little ground cover, consequently exposing the top soil to wind erosion. All the variety test locations in eastern Colorado have been examined during the past fifteen days and none of them appear significantly damaged by the freeze. However, at several locations "Winter Tender" experimental lines were identified. Wind damage has occurred at five of our test locations.

The four different kinds of freeze injury, i.e. 1. winter kill, 2. freeze after dormancy is broken in the spring, 3. cold temperature in the boot stage, and 4. freezing injury after anthesis, occurred in 1989. Articles were mailed in 1989 and 1990 to Extension agents describing freeze damage in detail. The present freeze damage needs further discussion and the possibility of spring freeze damage is a real concern until after heading. The above document will be updated and mailed soon. (Echols)

EVALUATING ALFALFA STANDS FOR WINTER INJURY

Since snow cover was minimal this past winter, alfalfa stands may have winter injury, resulting in stand depletion.

The best time to evaluate alfalfa stand loss is when plants are approximately 6 inches in height. At this time, erratic spring growth and color variation associated with winter injury or death can be observed. Taller foliage will make it more difficult to recognize individual plants.

Entire fields should be surveyed to assess the extent of damage, since portions of the field may be worse than others. Healthy plants will have vigorous green growth, making them easy to recognize. Winter-killed plants will also be easy to identify. The crown will be brown and will be easy to pull out of the soil because the root is decayed.

Winter-injured plants are more difficult to assess. Damage can range from plants that are significantly stunted and yellow, to plants that have one-half of the crown growing, to plants that appear healthy with a few stunted stems. If confusion exists regarding the extent of injury, dig out the plants and cut the roots in half lengthwise. Healthy roots appear creamy white and injured roots have yellowish-brown sections indicating tissue death. Slightly damaged plants will usually recover, particularly if the stand receives adequate water and nutrients during early spring growth.

If, after these observations, there are less than five live plants/ft.^{2}, the stand would be considered less than marginal and should probably be replaced. A field showing winter injury and low plant population will be slow to recover after harvest and be susceptible to disease and weeds. If the stand is marginal, harvest should be delayed beyond the optimum date (1/10 bloom) for quality and yield, allowing plants to replenish root reserves.

Management factors to minimize winter injury include replenishing root reserves and improving soil moisture. The optimum date for final harvest is approximately 30 days prior to the average killing fall frost. This allows plants to replenish root reserves resulting in healthy spring regrowth. Maintaining adequate moisture in the soil profile during the fall will minimize winter injury. Moist soils retain more soil heat throughout the winter than dry soil which results in better crown survival. Dry soil is more likely to result in severe winter kill. Alfalfa crowns can be protected from lethal temperatures by maintaining higher stubble (4-6") in the fall. This reduces wind velocity at the soil surface and will catch more snow. Both factors minimize the effect of cold winter temperatures on the alfalfa plant.
(Shanahan)

SEED DORMANCY*

The Colorado Seed Growers Association office often receives inquiries about lab results for seedlots which include seed dormancy. This is normally not a problem because dormancy usually breaks well before planting time. Plant breeders usually select plants for the non-dormancy characteristic. Wild plants and revegetation species recently taken under agricultural management, however, usually exhibit a deep seated type of dormancy. Such species include some forage grasses, legumes and most kinds of trees or shrubs.

Seed dormancy has evolved as a survival mechanism to particular climatic conditions. In our area, the main threat to survival is the cold weather prevailing during winter. If seeds of plants maturing during late summer or early fall germinated promptly, they would develop only to the seedling stage and then die during the winter. In other regions, prolonged wet and dry periods, or the extreme dry periods may cause problems.

Seed dormancy enables plants to survive seasonal hazards in the highly resistant seed stage. It distributes germination over time. But in domestic agriculture, dormancy prevents prompt and uniform seedling emergence, interferes with planting schedules and contributes to "volunteering" in other crops.

Seed dormancy is not restricted to a single cause or mechanism. The best known dormancy mechanism is probably impermeability to water, or better known as hard seed. Hard seeds have a coat that does not allow penetration of water into the seed. The embryo is not dormant. Some claim that hard seeds are insurance against stand failure or as a replacement for thinning seeds. Others contend that late germinating seeds will not compete well against established seedlings.

The other common dormancy is a true embryo dormancy. This type of dormancy is manifested as a complete inability to germinate or as a general sluggishness in early growth.

Hard seed dormancy is somewhat easy to break by using impaction, scarification, heat or cold, but seed can be damaged if handled incorrectly. Methods to break the difficult embryo dormancy are being developed, but time is still the best dormancy breaker.

Whenever one type of dormancy is reported on certified seed, it must be printed on the tag exactly as it came from the lab. If a seed grower does not want to report dormant seeds, a second germination test performed later in the season will normally show that dormant seeds no longer exist in that seedlot.
(Stanelle)

*Adapted from "Seed Dormancy" by Dr. J. C. Delouche, Mississippi State University. 1964.

DETERMINING BEST MANAGEMENT PRACTICES

There is considerable concern about how Best Management Practices (BMPs) associated with the implementation of Senate Bill 90-126 will be determined, how rigidly they will be defined, and how much input users will have in their development. This is an opportunity to explain how the program is proceeding to date.

The procedures to determine BMPs for the groundwater monitoring program and regulations for pesticide handling areas exceeding 55,000 pounds usage are still being developed. The SCS, EPA and State Soil Conservation Board are currently developing BMPs for a variety of purposes including water quality. During recent weeks, I have been meeting with farmers, commercial lawn applicators, golf course ground supervisors and homeowners to study the current chemical and water management practices. This information gained is supplemented with additional information from suppliers, consultants and various CSU specialists. This is providing me with improved understanding of current chemical and water management practices used throughout the State and why practices used in one area may not be suitable for another. For example, it is simple to include groundwater nitrates in a grower's nitrogen application program in the center pivot areas of the San Luis Valley, but almost impossible on the Front Range where farmers combine ditch water with well water, and when fertilizer is applied, they do not know the extent well water will be used.

It is clearly apparent that Colorado has a very diverse agricultural economy that limits the potential for broad state-wide generalizations. This may make it essential to make most BMPs area specific and to rely on local input to develop BMPs. I would expect that many BMPs will have several alternatives for users depending on preferences and equipment available. I actually would prefer the term BMAs (best management alternatives) to BMPs. The intention of Senate Bill 90-126 is that all BMPs are feasible and economical. It is also the intention that before BMPs become formally published, they are carefully reviewed by the users. This is expected to be done during Extension workshops and short courses.

I have discussed BMPs with various users and involved individuals. Most users are both aware and concerned with the potential environmental hazards from using agricultural chemicals. The trends in chemical use are toward more efficient applications that will reduce the environmental hazards. I thus see little difficulty in most users adopting BMPs.
(Tinsley)

FLUORIDE IN WATER

Requests for fluoride analysis are increasing at the Soil Testing Laboratory. Methods used for fluoride analysis include utilizing an ion selective electrode and ion chromatography. Two available colorimetric methods approved by the EPA and not used at the laboratory are Methods 340.1 and 340.3.

Most municipal water supplies contain about 1mg/l fluoride. Water supplies originating from wells, however, can contain varying fluoride levels. Most of the water samples examined at the laboratory contain very small amounts, usually less than 1 mg/l, of fluoride. However, some water samples originating from wells north and west of Ft. Collins have had very high levels of fluoride ranging from 10-14 mg/l.

The EPA has set a mandatory upper limit for fluoride in water at 4 mg/l. If a water sample contains fluoride levels between 2 and 4 mg/l, the water supply should be monitored periodically to ensure that the fluoride level does not exceed recommended limits. The most effective way to reduce high fluoride concentrations is by distillation or reverse osmosis. The most noticeable effect of high fluoride is darkening of the teeth. Fluoride has been implicated in several other ailments as well. (Self)

POOR CORN EMERGENCE

Because of dry cloddy seedbeds, crusting, uneven seed depth placement, chemical injury, and poor germinating conditions, fields have uneven corn emergence and different plant sizes. Occasionally, you see a field that has been double planted having "old" and "new" plants in the same row. Is this good or bad?

Uneven emergence effects grain yield. Large early maturing plants compete with smaller late emerging plants. Late plants may be covered during cultivation. Forage yield losses are not discussed in this article.

Here are questions to ask concerning different emergence patterns:

- What is the yield loss of uneven emergence?
- Should you replant stands with unevenly emerging plants?
- What are the benefits for "filling in" a poor stand compared to tearing up the field and starting over?
- Should you protect late emerging plants or are they just weeds?

Answers to these questions should be obvious after studying the following data (Table 1).

Table 1. How uneven emergence affects corn grain yield.

	Planting time & row pattern	Prop. of delayed plants	Grain Yield as % of Max.
Full stand even emerg.	E	None	100
	M	All	95
	L	All	88
Full stand uneven emerg. alt. row pattern	E and M	1/2	94
	E and L	1/2	85
Full stand uneven emerg. within-row pattern	EEEM	1/4	94
	EM	1/2	91
	EEEMM	1/2	93
	MMME	3/4	93
	EEEL	1/4	90
	EL	1/2	79
	EEELLL	1/2	80
	LLLE	3/4	78
Reduced stand plants missing		Prop. of missing plants	
	EEEX	1/4	90
	EX	1/2	71
	EEEXX	1/2	69
	X	3/4	49
	XXXE		

E = Early planting
M = Planting 1½ weeks after early planting.
L = Late Planting 3 weeks after early planting.
X = Missing plants.

Experiments in Illinois and Wisconsin, showing corn yield reduction from various stands, maturities and delayed emergence, indicate grain yield as % of maximum in Table 1. Two hybrids were planted at 26,000 plants per acre at early (E), medium (M) and late (L) dates. To simulate emergence delays, corn was planted either 1½ or 3 weeks after the optimum early date. Various in-row patterns produced ¼, ½ and ¾ E, M, and L plants. Alternate row patterns, having different emerging times, were included to compare early vs medium and early vs late plantings. Reduced stands studying the effects of missing plants are indicated with an (X).

To interpret the table, go to the first row down the left side. The next field to the right indicates early, medium and late planting. Medium planting - 1½ weeks later, decreased grain yield 5 %. Late planting - 3 weeks later, decreased yield 12%. If early planted corn made 175 bu/acre, then the loss is 21 bu/acre comparing early vs late planting. By comparing LLLE in the 3rd row down, 3 plants out of 4 emerged 3 weeks later and the yield loss is 22% or 38 bu/acre when early planted corn yielded 175 bu/acre. Missing plants in the last row create even larger losses. Is poor, uneven corn emergence good or bad? (Croissant)

EFFECTS OF ROW ARRANGEMENT, BED WIDTH AND PLANT POPULATION ON DRY BEANS

Optimum growing conditions for crops are necessary to realize their full yield potential. This is especially important in pinto beans because new varieties possess bush, upright and vine growth habits. Irrigated dry beans in Colorado are normally planted in single row arrangement on a bed, and bed widths are 30 inches. Since new pinto varieties possess different growth habits, there is need to evaluate the specific performance of each growth habit under different cultural practices. Field research was conducted under irrigated conditions at Fort Collins and Fruita in 1989 and 1990. The research objective was to determine the performance of three pinto cultivars possessing bush, Type I (RB 85232), upright, Type II (Cinnabar), and vine, Type III (Bill-Z) growth habits under two bed widths (narrow vs. wide), two row arrangements (single vs. double rows on a bed), and two plant populations (low=72K and high=114K plants/acre). The narrow bed width was 22 and 24 inches at Fort Collins and Fruita, respectively. The wide bed width was 30 inches at both locations. The treatments were tested in a split-plot design with four replicates. Growing conditions were good at both locations. However, a hail storm severely damaged the Fort Collins plots in 1990.

Seed yield of all three growth habits was consistently higher under narrow bed width over both years and locations (see Table 2). Pod number, leaf area index (LAI) and light interception were also higher at the narrow bed widths. Pod number was most closely associated with seed yield. Double row arrangement produced higher seed yield than single at Fort Collins in both years. Pod number, LAI, and light interception also exhibited similar trends. However, row arrangement did not consistently influence seed yield at Fruita. Plant population did not influence seed yield or growth variables at either Fruita or Fort Collins in 1989. However, in 1990 when a hail storm severely damaged the plots at Fort Collins, higher seed yield was obtained at the high plant population. Growth habits did not interact with other factors for seed yield in 1989.

These results suggest that the three growth habits responded similarly to planting arrangements and density. Seed yield was increased by planting on narrow beds with two rows on a bed. However, seed yield increase due to double row arrangement was not consistent between the locations. Michigan research has also indicated that bean yields can be increased by changing from 30 to 22 inch rows (Bean Talk, March 1991). The Michigan study determined that gross profit margins increased $37/acre by planting in 22 inch rows compared to 30 inch rows. Furthermore, Brazil now recommends that production practices include planting dry beans in double rows spaced 20 inches apart, or single rows spaced 12 inches apart (Michigan Dry Bean Digest, 14:2-9, 1990).

This report was conducted for the MS degree by Kirshan Mehrajat at CSU. (Brick)

Table 2. Mean seed yield of three pinto bean cultivars which differed for growth habit grown under narrow and wide bed spacing, and single and double row arrangement on a bed at Ft. Collins and Fruita CO in 1989 and 1990.

		Fort Collins, 1989			Fort Collins, 1990			Fruita Mean 1989-90		
	Row	Growth Habits Of Cultivars								
Bed width	Arrang.	I	II	III	I	II	III	I	II	III
		lbs/acre								
Narrow	Single	2683	2243	2525	1084	1128	1661	3615	3341	4074
	Double	2960	2449	3040	1536	1536	1978	3533	3247	3934
Wide	Single	2537	2055	2264	831	931	1264	3068	3117	3774
	Double	2932	2432	2616	1339	1346	1971	3361	3162	3643
LSD (0.05)*		139	139	139	143	143	143	119	119	119

* Means within columns separated by less than this value are not significantly different ($p < 0.05$)

Where trade names are used, no discrimination is intended, and no endorsement by the Cooperative Extension Service in implied.

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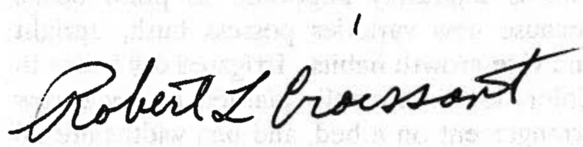
Sincerely,



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