more promptly or perhaps provide better shelter and other care when the weather is definitely on the severe side. Some observers feel that changeable weather such as encountered in the fall and spring is more difficult for the animal to adapt to, and more conducive to disease development, than is the more severe but less variable winter weather. Other rather doubtful possibilities would include such possible though improbable circumstances as the poorest husbandman purchasing calves each of the three falls (at one auction at least) and the best husbandman purchasing calves in the winter.

Table 2 infers another factor which may provide a partial explanation. Immune lactoglobulins and gamma globulins are thought to be measurements of immune substances found in the blood of young animals. Comparing the per cent sick and died with the seasonal blood value for immune lactoglobulin would suggest that the cow may produce more immune substances during the stress of winter and pass these to the calf through the colostrum (calves themselves are reportedly poor at forming their own immune fractions prior to 8 weeks of age). The gamma globulin values would not support this theory. The high value for per cent sick in the winter would suggest increased immunity during this season to account for the fewer fatalities.

Table 2. Lactoglobulin, gamma globulin values.

	Units Immune Lactoglobulin	% Calves Died	% Calves Sick	% Gamma Globulin
Fall	79.1	16.5	17.4	23.7
Winter	92.8	3.3	23.6	20.9
Spring	89.7	7.7	21.9	21.0

If gamma globulin is a better measurement of immune fractions than is immune lactoglobulin (nobody claims to know for certain the "best" means of measuring immunity), this information would indicate that increased stress and challenge factors in the fall (when gamma globulin is highest) more than offset any advantage supplied by the increased serum gamma globulin.

Whatever the reason for the seasonal difference in death loss among young calves, practical application of the foregoing information does not suggest that the herdsman drop his guard in the winter. Rather it points out the need for better attention to housing, management, feeding and disease prevention details in the fall and spring when some may least expect trouble. It also casts doubt on the commonly accepted idea that winter is a particularly bad time to purchase and rear hand-fed calves, providing they are not subjected to undue stress and exposure.

Residual Effect Of Zinc Fertilizer On Corn Grain Yield

Armand Bauer

In a previous paper it was reported that corn grain yield was increased by zinc fertilizer in 1966 when applied immediately before or at planting on some soils in southeastern North Dakota (1). A band application of one pound of zinc (Zn) from Na_2Zn EDTA increased yields 12 to 14 bushels per acre at two sites. Data in this paper showed that corn grain yield was increased in 1967 at one of these two sites by zinc fertilizer applied broadcast prior to planting of the 1966 crop. Grunes et al. (4) found that corn grain yield was increased in 1956 by zinc applied just before planting in 1954, at the Deep River Development Farm at Upham, North Dakota. Zinc sulfate ($ZnSO_4$) was drilled to a depth of 3 inches and in rows 6.5 inches apart at a rate supplying 15 pounds Zn per acre.

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Methods

The residual effect of the zinc fertilizer was determined at three sites. Except for thinning to the desired population and harvesting and processing of a representative sample, the cooperators performed all the necessary operations. Plant population established by thinning was 18,000 per acre. Fertilizer application rate and method and corn variety grown in 1967, as reported by the cooperators, were as follows:

A. Ista

Broadcast 300 pounds per acre of 25-25-0. Applied 100 pounds per acre of 17-17-17 as a band by planter attachment. Variety was SX 48 P.A.G. in 30-inch rows.

W. Haverland

Broadcast 200 pounds per acre 25-25-0. Applied 125 pounds per acre 17-17-17 as a band by planter attachment. Variety was Funks 4110 in 30-inch rows.

R. Kummer

Broadcast 200 pounds per acre 25-25-0. Applied 125 pounds per acre 17-17-17 as a band by planter attachment. Variety was Agsco 100-day corn in 40-inch rows.

Details of the 1966 experimental procedure and other pertinent information are published (1).

RESULTS

Corn grain yields obtained in 1967 are shown in Table 1.

Table 1. Effect of zinc[1] fertilizer applied in 1966 on 1967 corn grain yield.

Cooperator	Zinc (Zn) broadcast (lbs./acre)	Yield, bushels per acre (15.5% moisture) Zinc (Zn) rate banded (lbs./acre)			
		0	1	4	Ave.
A. Ista	0	98.2	106.2	91.2	98.6
	2	96.8	101.5	101.2	99.8
W. Haverland	0	83.9	84.4	86.6	84.7
	2	91.8	98.6	92.9	94.4
R. Kummer	0	28.9	42.4	42.7	38.0
	2	45.7	34.6	33.2	37.8

[1]Source was Na_2Zn EDTA. (di-sodium zinc ethylene di-amine tetra-acetate).

Zinc (Zn) from Na_2Zn EDTA broadcast at a rate of two pounds per acre in 1966 increased corn grain yield at the Haverland site in 1967 (84.7 vs. 94.4 bushels per acre). Zinc fertilizer also increased corn grain yield at this site in 1966. But yields are not statistically different at the 5 per cent confidence level[1] at the Haverland site for the band application method or at the other two sites, irrespective of application method.

[1]Means that the odds are less than 95 out of 100 that the differences are due to treatment rather than to chance.

DISCUSSION

Although the zinc fertilizer used in these experiments, Na_2Zn EDTA, is considered mobile in soil (2), the yield increase in 1967 from residual zinc at the Haverland site was obtained from broadcast applied fertilizer. Apparently, movement of the Zn EDTA banded in 1966 was not great enough to have an effect on the 1967 crop. While Na_2Zn EDTA, an organic source of zinc, is considered mobile in soil, zinc (Zn) from inorganic sources such as zinc sulfate is considered immobile (2) except in acid soils of low cation exchange capacity (5).

No explanation can be given for the failure to obtain yield responses to residual zinc at the Ista site in 1967. Corn grain yield was increased by zinc fertilizer in 1966.

Yields at the Kummer site were not increased by zinc in 1966 when yields exceeded 132 bushels per acre, hence no increases could be expected in 1967 when yields were much lower. The 1967 yields were extremely variable among replications.

Carryover of zinc fertilizer to the next season, or beyond, even at rather modest application rates, points up the fact that the costs of material and application need not always be charged in the entirety against the crop grown the year of application.

Zinc sources are not equally effective on a pound-for-pound Zn basis in increasing corn grain yields on zinc-deficient soils. In general, one pound of zinc (Zn) from organic sources, such as Na_2Zn EDTA, is about as effective as 4 to 5 pounds from an inorganic source, such as zinc sulfate (3).

SUMMARY

Zinc (Zn) from Na_2Zn EDTA applied broadcast at planting in 1966 at a rate of two pounds per acre increased the 1967 corn grain yield at one of two sites at which yields were increased by zinc fertilizer in 1966.

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