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EFFECT OF SEED SOURCE AND TREATMENT ON THE CONTROL OF ZINC DEFICIENCY IN LINSEED

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SUMMARY

Neither the use of seed from a zinc fertilized crop nor the application of zinc sulphate to seed is a satisfactory alternative to plant or soil applications.

I. INTRODUCTION

Duncan (1968) has shown that zinc-deficient linseed must be treated early in growth with zinc spray in order to produce an effective cure. This fact, together with the uncertainty because of weather conditions of being able to use spray machinery at the critical growth stage, and the much higher cost of soil dressings, led to the investigation of an alternative approach. This paper discusses the effectiveness of using increased seed zinc content as a means of control. Direct treatment of seed with sinc sulphate and the use of seed from a mother crop heavily fertilized with zinc were investigated.

II. METHODS AND MATERIALS

In a glasshouse experiment, linseed was grown on a zinc-deficient Waco black earth (Beckmann and Thompson 1960) using seed from different sources and seed variously pretreated with zinc sulphate (Table 1).

The trial comprised 8 seed treatments x 2 soil zinc treatments (0 and 100 kg $ZnSO_4.7H_2O$/ha equivalent) x 3 replications, set out in a randomized complete block factorial design. Plants were harvested after 8 weeks.

III. RESULTS AND DISCUSSION

The efficiency of seed source and treatment in counteracting zinc deficiency can be gauged by expressing vegetative yield from the various seeds as a percentage of the yield from the same seed fertilized with 100 kg $ZnSO_4.7H_2O$/ha. Results are shown in Table 1.

TABLE 1

YIELD FROM VARIOUS SEED TREATMENTS EXPRESSED AS A PERCENTAGE OF THE YIELD FROM THE SAME SEED FERTILIZED WITH 100 kg $ZnSO_4.7H_2O$/ha

Treatment No.	Treatment	Percentage of Zn-fertilized Yield
1	Seed from a zinc deficient crop	27·3
2	Seed from an unfertilized healthy crop	27·8
3	Seed from a healthy crop fertilized with 100 kg $ZnSO_4.7H_2O$/ha . .	40·8
4	Commercial seed	53·3
*5	Commercial seed—soaked in water for 5 min	49·6
*6	Commercial seed—soaked in 10% zinc sulphate for 5 min	68·6
*7	Commercial seed—soaked in 20% zinc sulphate for 5 min	94·0
8	Commercial seed pelleted with 1 lb $ZnSO_4.7H_2O$ per 10 lb seed . .	65·2
	Necessary differences for significance 5%	13·7
	1%	18·2

* ·1% " Teepol " (wetting agent) was used. Seeds were dried at 40°C without washing.

Seeds used in treatments 1, 2 and 3 were obtained from experimental plots harvested 2 years previously. Seedling growth from these in the pot trial was significantly less thrifty than that from commercial seed. Therefore a true comparison of treatments is only possible within the groups 1 to 3 (seed source) and 4 to 8 (seed treatment).

From the seed source comparisons it is apparent that, while seed from a zinc-fertilized crop tended to reduce the degree of zinc deficiency, it fell far short of a complete cure. Chemical analysis of this seed (Table 2) showed that even the heavy zinc fertilization used on the mother crop (100 kg $ZnSO_4.7H_2O$/ha) did not markedly increase seed zinc.

TABLE 2

ZINC CONTENT OF SEED FROM TREATMENTS 1, 2 AND 3

Treatment No.	Seed Source	Average Seed Weight (mg)	Average Zn per Seed (μg)	Average Zn per Seed Embrryo* (μg)
1	Seed from a zinc-deficient crop	8·8	0·24	0·16
2	Seed from an unfertilized healthy crop	8·4	0·28	0·18
3	Seed from a healthy crop fertilized with 100 kg $ZnSO_4.7H_2O$/ha	9·2	0·34	0·22

* Data obtained by analysis of the embryo after germination and natural shedding of the testa.

As approximately 20 p.p.m. Zn is an adequate tissue level for healthy linseed (Whitehouse and Leslie, unpublished data), seed from the heavily zinc-fertilized crop is capable of supplying sufficient zinc for only 0·002 g more tissue than the unfertilized seed source. This represents less than 1 day's growth.

The partial success of seed treatment 6 (10% zinc sulphate, soaked 5 min) and the almost complete success of treatment 7 (20% zinc sulphate, soaked 5 min) indicate that, provided sufficient zinc reaches the developing embryo, control of zinc deficiency is possible. However, this method of control would not be commercially advisable in that conditions of soaking require careful control. Soaking for longer than 5 min or at a higher concentration than 20% zinc sulphate significantly reduced seed germination.

While seed pelleting with zinc sulphate (treatment 8) provided a good supply of zinc on the seed testa (290 μg Zn, or sufficient for 15 g tissue) and also did not reduce germination, results with this treatment were only partly successful. This is probably attributable to the testa, on germination, being carried with the coleoptile through the soil surface and deposited on top of the ground. This mode of plant emergence together with the impermeable nature of the seed testa apparently prevented the developing embryo from utilizing the zinc coating.

The general conclusion from this experiment is that the seed treatments investigated are either unsuccessful or too impracticable to be considered as commercial alternatives to spraying or soil application in the control of zinc deficiency in linseed.

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