

Phosphorus and Nitrogen Deficiency Symptoms in Sugar Beets

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The symptoms of phosphorus and nitrogen deficiency are well known, but a shortage of both elements at the same time is not recognized. When phosphorus is lacking in the soil we usually find nitrogen is also low. In order to show the combined effect of phosphorus and nitrogen deficiency it will be best first to consider the elements alone.

The nitrogen content of the soil is determined by making the diphenylamine test on the petioles of beet leaves. Any good beet man can, of course, estimate the nitrogen supply in the soil by the color of the leaves. However, the test shows nitrogen deficiency before it is apparent in the color of the leaves.

The diphenylamine test is simple and reliable. The only restriction to its use is immediately following heavy rains or irrigations as the downward movement of water takes nitrates out of reach of the beets for a short period of time. A typical bronzed coloration of the beet leaf is indicative of a combined deficiency of phosphorus and nitrogen.

The final proof that the bronzed leaf is caused by phosphorus and nitrogen deficiency is shown by the analyses of bronzed versus normal leaves.

Phosphorus and Nitrogen in Bronzed and Normal Beet Leaves

Sample	Weight of beets	Weight of dry leaves (grams)	Nitrogen (%)	Phosphorus % P ₂ O ₅	Total	
					Nitrogen (grams)	Phosphorus (grams)
1. Bronzed	2 lb. 14 oz.	59.0	1.62	0.229	0.956	0.135
2. Normal	3 lb. 4 oz.	131.0	2.00	0.272	2.620	0.356
3. Bronzed	1 lb. 8 oz.	75.0	1.33	0.294	0.996	0.133
4. Normal	1 lb. 5 oz.	69.0	1.81	0.300	1.249	0.207
5. Bronzed	3 lb. 14 oz.	90.5	2.07	0.261	1.373	0.185
6. Normal	3 lb. 6 oz.	122.0	2.21	0.308	2.606	0.370
7. Bronzed	2 lb. 2 oz.	41.0	1.08	0.394	0.689	0.102
8. Normal	2 lb. 4 oz.	52.0	1.42	0.344	0.728	0.179
Summary or Average of Bronzed Versus Normal						
Bronzed	2 lb. 8¼ oz.	66.4	1.68	0.268	1.129	0.159
Normal	2 lb. 9¼ oz.	63.7	1.86	0.306	1.326	0.276
Normal exceeds bronzed		27.3	0.18	0.047	0.697	0.117

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The samples were taken by selecting a bronzed-leaf beet and a normal beet of about the same size growing nearby. These samples were taken in four fields in widely separated districts. The analyses show the weight of the bronzed leaves to be less than that of the normal leaves, and also lower in percentage and in total amount of phosphorus and nitrogen present.

Phosphorus-deficiency symptoms only appear when the amount of that element is very low. They indicate the extreme cases of phosphorus deficiency. The same is often true of the symptoms indicating low nitrogen. When leaves turn yellow in August the loss in yield is considerable. The symptoms of combined deficiency are believed to be a more sensitive indication than the symptoms showing lack of the elements alone.

The bronzed leaf does not appear over an entire field. It occurs on individual beets in scattered locations. These beets have a genetic weakness, or they have the inability to thrive on a given level of plant food. The other beets in the field which appear to be normal have lived under the same limited conditions, but have been able to do so without showing evidence of their need.

The small acreage representing extreme deficiencies of phosphorus and of nitrogen alone or in combination affect the individual grower seriously, but are not nearly so important as the large acreage where a moderate deficiency exists. Moderate deficiencies occur over a wide area, and even though the yield on these lands is only reduced from 2 to 4 tons per acre, the total loss is great. It may not be evident to the grower because the pronounced symptoms do not occur, but the loss nevertheless exists. Changes in yield of from 2 to 4 tons per acre are not easily seen in the field. A difference of 0.2 pound in the weight of two beets can hardly be detected by visual observation, but the small difference represents an increase in yield of the larger beet over the smaller one of 5,200 pounds per acre. Moderate deficiencies cause small difference in the yield of individual plants which accumulate to decrease the yield per acre. As there are so many deficient acres, the entire production of agricultural crops is greatly reduced.