gold Bantam Evergreen, Parade, Huron, Flagship, KVF 45-10, Double Duty. For white hybrids, try Silverliner or Truckers Hybrid. For large ears, Golden Grain is recommended.

Celery:—A new variety being recommended for trial in the celery growing sections is Emerson Pascal. Recently released and tested, it has high resistance to celery blight.

Potatoes:—Kennebec, a promising new white-skinned variety, has yielded about the same as the standard Sebago in tests at Hastings during the last four years. Its tubers are similar to those of Sebago in color, size and shape and earliness. It is moderately resistant to cracking; its resistance to brown rot is unknown. Kennebec is highly resistant to late blight. It is recommended for trial by growers. Dakota Chief is recommended for the Sanford area.

Cantaloupe:—Acreage of this crop is on the increase in the State. With the introduction of new fungicides capable of controlling downy mildew, the most destructive disease, and insecticides that are almost specific against the pickle worm and aphids, a number of varieties have been grown successfully commercially along the Gulf Coast.

There are commercial varieties that fill the needs of most demands for fruit size and quality. Of these the following are recommended: Powdery Mildew Resistant No. 45 and No. 5 produce medium size, well netted fruit; Hales Best and Hales Jumbo, medium and large fruit also well netted; Burrell Jumbo (a strain of Hales) and Smiths Perfect, a downy mildew resistant variety of delicious quality for local consumption. It will not stand shipping and rough handling. Two large muskmelons, Seneca Bender and Schoons Hardshell are recommended for trial. The latter is very resistant to worms; both have excellent quality.

Several new varieties almost immune to downy mildew were grown at the Vegetable Crops Laboratory last spring. These originated in Texas and Georgia and showed much promise. They produce heavily netted, medium sized fruit and have quality equal to Smith's Perfect. When seed of one or more of these varieties become available, it is possible that acreage of this crop will expand rapidly.

EFFECT OF LOW NITRATE NITROGEN ON GROWTH OF POTATOES

GAYLORD M. VOLK AND
NATHAN GAMMON, JR.
Florida Agricultural Experiment Station
Gainesville

A type of leaf roll occurring on Irish potatoes growing on acid flatwoods soils was brought to attention in March of 1949. Leaf margins were rolled upward and in toward the midrib. Stems and the under surfaces of leaves sometimes had a purple tint, but there was no leaf pattern of yellow or faded areas so commonly associated with a deficiency of some element. The trouble appeared mainly on Leon and similar soils of the Federal Point and Bimini areas. Later it was also found in the LaCrosse area.

The first symptoms appeared soon after the first thin leaves were formed, but usually became the most pronounced about blossom time. The leaf roll was permanent once it had taken place. It was also noted in subsequent examination of plants showing the symptom that tubers were set so close to the stem that movement of them

would be necessary for normal enlargement. This condition is commonly noted on potatoes that have been retarded for some reason, but in this case might have special significance in that it was present even when the above ground portion of the plant was normal in size and general appearance with the exception that the leaves were rolled.

No indication of a disease organism was found in connection with the rolling. Analysis of several soil samples collected from the various fields in the Federal Point and Bimini areas where the rolling was severe, showed that the soils were very acid and exceptionally high in ammonia nitrogen as compared to more normal portions of the same fields. This indicated that the bacterial activity necessary to convert ammonia nitrogen over to nitrate nitrogen might be inhibited. Incubation tests carried out in the laboratory did show this to be the case. With this lead, field tests were made in cooperation with the Hastings Potato Investigations Laboratory in which fertilizers carrying different ratios of nitrate to non-nitrate nitrogen were used in combination with various lime treatments.

Bimini Tests

Twenty-five hundred pounds of the various fertilizers were used per acre in the drill or split application. All materials were made physiologically neutral with dolomite except in treatment No. 4 where extra dolomite was added. Running across the rows were bands of lime and Cyanamid singly and and in combination. Lime was used at one-half and one ton rates and Cyanamid at 240 pounds.

Average yields for certain treatments in the 1950 test are as follows:

1950 BIMINI TESTS

No.	Treatment 2500 Lbs. per Acre	No Lime or Cyanamid	
		1949 Area of Curled Leaves pH 4.2 to 4.4	Not Curled in 1949 pH 4.7 to 4.9
		Av. Yield, 4 Plots	Av. Yield, 4 Plots
		I	II
2	5-6-6 2.0 units from nitrate	241 bu. (Normal leaves in 1950)	292 bu.
5	Same mixture as above, only 3/5 at planting and 2/5 side at 60 days	241 bu. (Normal leaves in 1950)	331 bu.
3	5-6-6 No nitrate All at planting	165 bu. (Rolled leaves in 1950)	313 bu.
4	Same as above plus 300 lbs. extra dolomite above neutral in fertilizer	183 bu. (Rolled leaves in 1950)	308 bu.
1	Grower's 6-8-8 .75 units from nitrate All at planting	201 bu.	312 bu.

From column I it will be noted that in the area where leaves were badly rolled in 1949, nitrate nitrogen in the fertilizer (No. 2) eliminated the symptom in 1950 and produced 46 percent greater yield than No. 3. Three hundred pounds of dolomite per ton above that needed to neutralize the high ammonia fertilizer (No. 4) improved the yield by 11 percent over No. 3 but did not eliminate the rolling of leaves.

The second column shows that at the higher soil pH where rolling was not severe in 1949, low nitrate fertilizer produced good yields. It should be noted that the split application of goods carrying 2.0 units of nitrate nitrogen (No. 5) produced the best yield. This indicates that leaching of nitrates probably took place to lower the yield with the No. 2 treatment. The greater the amount of nitrate nitrogen used in a fertilizer, the greater is possible need for side dressing with nitrogen later on if heavy rains occur. This fact, along with a reluctance to side dress, may partially account for the swing to lower nitrate and higher ammonia nitrogen in recent years. The latter does not leach readily.

The test with 300 pounds of extra dolomite in the fertilizer was made to test the effect of reducing acidity in the fertilizer band. Apparently there was some benefit and it was planned that further work be done along this line. However, Dunton, Bell and Taylor (1) have since reported on the effect of dolomite in the fertilizer band and have shown that the acidity migrates away from the band before the lime can react effectively to neutralize it. Soil pH dropped from 5.7 down to 4.4 two inches above the band even when 300 pounds of dolomite above that necessary to neutralize the fertilizer was used. The pH of the band did rise to approximately 6.2 temporarily but then dropped to 5.5 in two months. The increase noted in treatment No. 4 probably is the response to the effect of this temporary rise in pH on local nitrification.

Neither lime nor Cyanamid appeared to increase the yield by more than five percent where the soil pH was 4.7 to 4.9. Where the soil pH was 4.3 to 4.5, lime still did not improve yield but Cyanamid increased the yield by about 25 percent. The lime was applied in November and according to soil pH did not have time to react. Cyanamid probably helped by supplying a nucleus of quick acting lime hydrate and nitrogen together, so that nitrification was improved at the vicinity of each granule of material.

Hastings Tests

These plots were intentionally laid out on an area containing a spot of very light sandy soil. Yields were low and erratic. Treatment No. 2 containing nitrate nitrogen gave about 25 percent greater yield than No. 3, the low nitrate treatment. The main contribution from this test was the demonstration that rolling was not present on the better soils even in the absence of nitrates in the fertilizer, but that it did occur in the lighter sands with the high ammonia fertilizer.

There was no response to dolomite either in yield or pH change, therefore it was assumed that the lime did not have time for proper reaction because of time of application and the dry season.

Additional tests in which the per acre treatments with No. 3 and No. 4 materials were lowered did not reduce the rolling. From this it is assumed that the response was due to addition of nitrate nitrogen rather than possible reduction of toxicity of ammonia.

Analysis of plant tissue for ammonia and nitrate nitrogen showed that the rolling was progressively less where the nitrate nitrogen content of the tis-

sue increased, but there was no correlation with ammonia. There was no correlation with the amounts of calcium, magnesium, potassium, phosphorus, sodium or iron in the tissue on a limited number of samples tested.

One test on new land showed excellent response to nitrate nitrogen and to lime as compared to ammonia nitrogen, both in marked increase in yield and elimination of rolling of leaves.

Examination of soils for accumulation of soluble salts, chlorides especially, did not show this to be a factor in the problem.

Conclusions

Analysis of soils, plant tissue and yield data are quite conclusive in indicating that low nitrate supply to the potato plant is the cause of the rolled leaves. The amount of ammonia nitrogen is apparently not a factor except as it may produce a larger plant in which the symptoms of nitrate deficiency are more pronounced when a stress period, probably of moisture supply, sets in. Normally fertile soils of the areas in question will nitrify ammonia fast enough to supply nitrates from ammonia in an average year. The more acid the soil, the greater the possibility of poor nitrification. On a very dry year more soils would fall in the group not having adequate nitrate producing ability.

Apparently the trouble is characteristic of very sandy soils and certain very acid soils; the first because leaching of nitrate and even ammonia nitrogen is rapid, and the second because nitrification is very slow at *low pH.* Just where the critical pH lies is not definitely known, but liming when the pH is 5.0 or below should be in order. This is in agreement with findings reported by Odland and Allbritten (2) that a soil reaction between 5.0 and 5.5 seems advisable in order to obtain the best yields of potatoes with the least scab. Soil samples taken in October and early November at a time when the soil is not wet are the most reliable for pH determination. Lime hydrate should be used for quick action but agricultural limestone, either calcic or dolomitic, is satisfactory if applied in early summer.

Five hundred pounds of hydrated lime or 1000 pounds of agricultural limestone are adequate at one time. A recheck of pH will determine if the treatment needs repeating the next year. The possibility of a year of poor nitrification is such that fertilizer should carry at least one unit of nitrate nitrogen.

For those areas where rolling has been prevalent and pH is below 5.0, it is suggested that in addition to recommended liming, one-third of the nitrogen be from nitrate sources. *The grower must be prepared to side dress with a nitrate carrier if heavy rains occur.*

LITERATURE CITED

1. Dunton, E. M., Jr., Bell, F. W., and Taylor, M. E. The influence of acid-forming and neutralized fertilizer on the soil reaction and nutrient level in the Irish potato row during the growing season. *Agron. J.* 42: 512-515. 1950.
2. Odland. T. E., and Allbritten, H. G. Soil reaction and calcium supply as factors influencing the yield of potatoes and the occurrence of scab. *Agron. J.* 42: 269-275. 1950.