Mineral Nutrition of Stocks

need for potassium can be anticipated by soil analysis to determine calcium-potassium ratio

Garth A. Cahoon and Duane O. Crummett

Stocks—*Matthiola incana* — comprise the second largest floricultural field crop, in terms of acreage, produced in California.

In recent years, the average annual production has been above 900 acres. The yearly gross value of the crop is between two and three million dollars.

Nutritional studies recently conducted have found this plant to be normally high in potassium. Contents of 4% to 6% potassium in the dry leaf tissues were common.

A field survey completed in 1953, covering 35 plantings in 27 representative areas of six counties, indicated a mean potassium content of 3.43% dry weight in the lower leaf samples. The potassium-deficient plantings included in this average survey value had percentages ranging from .67 to 1.59. The better fields, in contrast, contained levels between 3% and 6% potassium in the lower leaves.

Growers consider good plantings of stock to have 12 to 16 plants per linear foot of row. This, as shown by the photograph, creates a dense ground cover as well as significant root competition for plant nutrients and moisture. If an average of 12 plants are grown per linear foot in rows 30 inches apart and they produce a mean dry weight of twenty grams per plant, there would be 4.6 tons of dry plant material per acre. This would remove about 323 pounds of potassium per acre from the soil—assuming an average tissue content of 3.5% potassium—and at least 369 pounds of nitrogen.

Correlation Coefficients Representing Comparisons between Plant and Soil Analysis.

Plant potassium:	
Bottom leaves × Soil potassium	.094
Bottom leaves × Soil calcium	–.595*
Bottom leaves × Soil Ca/K	–.708*
Bottom leaves × Soil Cat./K	–.706*
Top leaves × Soil potassium	.050
Top leaves × Soil Ca/K	–.582*
Plant calcium:	
Bottom leaves × Soil calcium	.455*
Top leaves × Soil calcium	.498*
Plant sodium:	
Bottom leaves × Soil sodium	.439*
Bottom leaves × Soil Ca/K	–.057

* Significant at .01 level.

Sixteen commercial varieties of stocks were tested under comparable conditions as to their relative ability to absorb and utilize potassium. Although differences were found among the varieties that were statistically significant, they were not large enough to be considered important under commercial growing conditions. Increasing the potassium level was reflected in the plant by the greater dry weight, stem diameter, nitrate and potassium content, although it did not influence the height of the plant.

A series of experiments aimed at determining the critical level for potassium deficiency in stocks showed that in the absence of sodium and ammonium ions, the visible symptoms appeared on the leaves when they contained from 1.2% to 1.5% potassium. Sodium appeared to be of benefit to stocks under conditions of low potassium. Below a certain point, however, it could not substitute for potas-

Concluded on page 15

An excellent example of stock production, showing the relative distances between rows and the competitive growth of plants within the row brought about by close seeding methods.

of the collapsed trees—100%—may actually have lost some of their mineral content through leaching and therefore have a lower sodium content than the trees 75% declined.

These data lend support to previous results obtained at Riverside indicating that relatively high sodium content of roots was associated with a high degree of decline in lemon trees. Although a high sodium content of roots has been found to be associated with trees exhibiting severe decline symptoms, this is not critical evidence that sodium is the cause of decline.

A known direct cause of tree collapse is root deterioration resulting from the girdling action of sieve tube necrosis at or near the bud union. It is possible that increased sodium absorption by roots—instead of being the cause of sieve tube necrosis—may be a result of a change in the physiology of root cells. The root cells may have become depleted of reserve carbohydrates after the sieve tube necrosis—caused by unknown factors—has reduced the movement of carbohydrates from the leaves to the roots.

The question of the relationship of sodium to decline and collapse of lemon trees is being further investigated by observing the effect of varying the amount of sodium in the soil and by periodic analyses of roots in an orchard where collapse is occurring.

D. R. Rodney is Assistant Horticulturist, University of California, Riverside.

S. B. Boswell is Principal Laboratory Technician, University of California, Riverside.

The above progress report is based on Research Project No. 1544.

STOCKS

Continued from page 10

sium; the weight of the plants decreased and deficiency symptoms developed.

Stocks appear to be among those plants tolerant to sodium as well as those requiring moderate to large amounts of potassium and nitrogen.

A compilation of the information from the available experimental data suggests that 3.5% potassium in the dry leaf would appear to be a desirable amount for promoting optimum growth and flower production. However, the necessary concentration of potassium needed in the soil to maintain 3.5% potassium in the plant could not be easily determined. The reason for this seemed to be due to the influence of other cations, principally calcium, in the available fraction of the soil.

As shown by the table of correlation coefficients on page 10, calculated from the data of the field survey, the total potassium present in the plant was not correlated with the ammonium acetate extractable soil potassium—a coefficient of .050 in the top leaves; .094 in the bottom leaves. Thus it is possible for the extractable soil potassium to be high but the plant potassium to remain low or the extractable soil potassium to appear low and the plant potassium to be high.

The calcium-potassium ratio in the soil, however, produced a highly significant coefficient— −.708—as did the cation-potassium ratio— −.706—when compared with the potassium content of the lower leaves. These ratios, by comparison, greatly influenced the absorption of potassium by the plant. A high ratio—of calcium to potassium—was associated with low plant potassium and a low ratio with high plant potassium. Therefore, excessively high calcium in the presence of moderate to low potassium may decrease potassium absorption sufficiently to induce potassium deficiency. Under such circumstances as these, the soil potassium measurement alone would not necessarily reflect a true picture of the potassium needs of the plant. Sodium and calcium in the plant were found to be significantly correlated with sodium and calcium in the soil.

The value of soil analysis in predicting the availability of soil potassium for stocks appears to be indicated by the calcium-potassium ratio more than any other measurement used.

Garth A. Cahoon is Junior Horticulturist, University of California, Riverside.

Duane O. Crummett was Assistant Plant Physiologist, University of California, Los Angeles, at the time this study was made.

BURNS

Continued from page 9

character of incendiary fires in the foothill range area has changed somewhat in the last eight years.

Size acres	Costs of controlled burns per acre			Cost of wildfire suppression per acre
	To permittee	To state	Total cost	
40	$2.95	$.70	$3.65	$5.50
80	2.50	.55	3.05	4.60
120	2.10	.50	2.60	3.80
160	1.75	.40	2.15	3.10
200	1.45	.35	1.80	2.45
240	1.15	.30	1.45	1.95
280	.95	.25	1.20	1.55
320	.75	.20	.95	1.20
360	.60	.20	.80	1.00
400	.50	.15	.65	.85
440	.45	.15	.60	.80
480	.45	.20	.65	.85
520	.45	.20	.65	1.00
560	.55	.25	.80	1.25
600	.65	.30	.95	1.60
640	.80	.40	1.20	2.05

The study clearly demonstrated that firing of brushlands with no plan or effort thereafter to maintain an open cover to favor invasions of desirable herbaceous vegetation is likely to be wasteful of time and money. Moreover, burning of inferior sites, such as those occupied by chamise or manzanita where the soil is thin and the slopes are steep, as is often done, is seldom profitable for livestock grazing.

There is still much room for better management of burned areas, such as reseeding for soil protection and for increasing forage yield; proper grazing use; and treatment to control seedlings and sprouts, though there is a definite trend toward an improvement of this situation. As more information becomes available, through research presently in progress, the acreage of unmanaged burns should decrease.

L. T. Burcham is Senior Forest Technician, Range Improvement, California Division of Forestry.

Arthur W. Sampson is Professor of Forestry, Emeritus, University of California, Berkeley.

The foregoing study was a cooperative project between the California Division of Forestry and the University of California, Department of Forestry research project No. 1294.

KHAPRA BEETLE

Continued from page 7

surface deposit of 1,000 micrograms per square centimeter of DDT, malathion, lindane, aldrin, dieldrin, parathion, chlordane, methoxychlor, DDD, and allethrin.

In the use of admixed dusts, 40 days were required to kill 90% of the larvae confined on wheat treated with eight ppm — parts per million — malathion dust, and at two ppm only 26% were killed. Similar experiments on the adults of rice weevil, granary weevil and lesser grain borer when exposed nine days to wheat treated with two ppm malathion dust resulted in 100% kill.

In the fumigation experiments, several times as much acrylonitrile or methyl bromide was required to kill 95% of the larvae as was required to kill adults of the rice weevil, granary weevil and lesser grain borer.

Both the contact and fumigation tests were conducted on larvae collected at Imperial in early March 1954, and these may have been overwintering larvae which are possibly more resistant to insecticides than the more active larval stages.

D. L. Lindgren is Entomologist, University of California, Riverside.

L. E. Vincent is Principal Laboratory Technician, University of California, Riverside.

H. E. Krohne is Laboratory Technician, University of California, Riverside.