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Nitrogen, Magnesium, and Boron Applications Affect Cauliflower Yield, Curd Mass, and Hollow Stem Disorder

This article by K. M. Batal, D. M. Granberry, and B. G. Mullinix, Jr., appeared in HortScience 32(1):75-78. 1997.

Scientists at the University of Georgia recently evaluated the effects of three rates of N, Mg, and B on cauliflower (*Brassica oleracea, Botrytis* group) yield, average curd mass, and hollow stem disorder (HDS) on sandy and clay loam soils.

Cultivars 'White Empress' and 'Stovepipe' were tested on the sandy loam soil, and 'White Empress' was tested on clay loam soil. Maximum mean curd mass and maximum yields were obtained with the highest N rates (240 and 340 lbs/A) applied to sandy loam and clay loam soils, respectively. Yield response to increased N rates varied with cultivar. Increasing Mg from 20 to 80 lbs/A did not affect yield or curd mass on clay loam soil, but increased yield and mean curd mass on sandy loam soil. The Mg effect on curd mass was influenced by N and B rates. On both soil types, the higher Mg and B rates reduced the incidence of hollow stem, but the Mg effect was influenced by N applications. On clay loam soil, increased B from 2 to 8 lbs/A reduced hollow stem, but had no effect on yield or curd mass. On sandy loam soil, B at 4 lbs/A maximized yield and curd mass, but the hollow stem disorder continued to decrease as B rates were increased by 2 to 8 lbs/A.

Further evaluations of N. Mg, and B fertilization, along with a complete assessment of B composition in young and old leaves, in head tissue, and elemental recovery analyses are needed to better understand the interrelationships of these elements in curd growth and the development of HSD.

This study demonstrated that HSD can be reduced by B and Mg, but the efficacy of these elements is influenced by rates. Cauliflower cultivars differentially responded to N rates. This probably resulted from the genotypic influence on growth and maturation of the 2 cultivars. Nitrogen and Mg were equally effective in improving average head mass and total yield of 'Stovepipe' and 'White Empress'. Boron also influenced cauliflower growth, and maximized curd mass. Optimal rates of these elements and specific timing of application for different soil types and environmental conditions need to be determined.

'Purple' a New Tomatillo Variety Now Available

By Dr. Frank J. Dainello, Extension Horticulturist - Commercial Vegetable Crops, Texas A&M University, from an article appearing in The Tomato, page 15, Feb/March 1997.

It wasn't too long ago when times were simpler in the produce world. Cauliflowers were white, peppers were green, carrots were orange. Not so today! What can one expect? We live in the age of the 'designer' -- we have designer clothes, designer cars, and, of course, designer vegetables. Even the lowly tomatillo has been caught up in this rage.

Johnny's Select Seeds has developed and released a purple tomatillo which they appropriately named 'Purple'. This variety is claimed to have a deep purple skin, matures in 65 days, and is intended for the fresh market and/or as a novelty shipping item.

Using Plant Deficiency Symptoms to Determine Fertilizer Needs

From Nutrient Deficiencies and Toxicities in Crop Plants, edited by William F. Bennett, Chapter 1, pp. 1-7, APS Press, The Am Path Soc, St. Paul Minnesota.

Nutrient deficiency symptoms can be used to determine the nutrient needs of crops, especially when they are specific for a particular nutrient. Yellowing down the midrib and eventual dying of lower leaves is a specific indication of N deficiency, whereas chlorosis and necrosis on the outer edges of lower leaves specifically indicate K deficiency. However, many symptoms can be caused by any one of several nutrients or by other conditions. Yellowing and inter-veinal chlorosis of young, newer leaves could be due to S deficiency, or it could indicate a deficiency of one of the metal micronutrients, Fe, Zn, Mn, or Cu. A knowledge of soil pH and general soil conditions may be needed to determine whether the yellowing results from lack of S or one of the micronutrients. Sulfur deficiency symptoms seldom appear on high-pH soil, whereas deficiencies of Fe, Zn, Mn, or Cu seldom occur on low-pH soils.

Typical deficiency symptoms can also be caused by many other conditions. Certain herbicides, diseases, and insects can cause chlorosis in plants. Waterlogged or droughty soils and mechanical or wind damage can often create problems that mimic deficiencies. Deficiency symptoms should be used only as a guideline for determining need. Symptoms plus plant and soil analyses, together with a general knowledge of crop needs and the chemistry of the soil, should all be used in determining crop nutrient needs.

Determining Nutrient Needs. In a crop production program, the most difficult requirement for the grower is to estimate accurately the fertilizer needs of the crop. An effective method for estimation is outlined in the following 5-step program.

1. Start with a visual diagnosis. Carefully observe plant growth for any unusual leaf symptoms. Symptoms should be noted as early as they appear in the field; they may be less easily classified later on, because they have been modified by other factors.

2. Second, verify the visual diagnosis by comparing analyses of leaves with and without deficiency symptoms with critical values reported for crops. Table 1 gives plant analysis guidelines. Comparable leaf samples, with and without symptoms, should be collected for chemical analysis at the same time, since the plants may outgrow the symptoms. For example, in most crops a P deficiency induced by low soil temperature may be overcome by a higher soil temperature. Also, when look-alike symptoms appear, chemical analysis can distinguish leaf scorch caused by drought or windburn from that caused by K and Mg deficiency, or even a K-deficient scorch from an Mg-deficient scorch. When the symptoms have been identified correctly, the analyses will be in the range that has been reported critical for most crops.

3. Third, fertilize with the required nutrients, either on a trial basis or over the entire field, leaving an unfertilized area for comparison.

4. Fourth, confirm by taking leaf samples from the field plots after rainfall or irrigation has been sufficient to ensure that the fertilizer added was actually absorbed by the plants and that the deficiency has been corrected.

5. Fifth, prevent nutrient deficiencies and crop losses in the current and succeeding crops by following a planned soil and plant analysis program. A systematic plant analysis program can be used not only to prevent nutrient deficiencies but also to avoid overfertilization. Adding fertilizer as insurance when the soil nutrient supply is already adequate is not only uneconomical but is often politically unacceptable when it is perceived as a possible pollution source.

Success in the 5-step program will be enhanced when the physical and chemical properties of the soil are fully characterized as well as those of the fertilizer materials required to correct any deficiency from plant to harvest. Although deficiency symptoms can be helpful in diagnosis, they are only one of several diagnostic tools that can be used to determine the nutrient status and nutrient needs of plants. Three other techniques commonly used include chemical soil tests, chemical plant tissue tests, and biological tests. The best method of determining nutrient need is to use 2 or more of the techniques.

Table 1. General guidelines for critical, sufficient, and toxic levels of plant nutrients [a]

Elements	Critical level	Sufficient range	Toxicity level [b]
N, %	<2.0	2.0-5.0	Nontoxic
P, %	<0.2	0.2-0.5	Nontoxic
K, %	<1.0	1.0-5.0	Nontoxic
Ca, %	<0.1	0.1-1.0	Nontoxic
Mg, %	<0.1	0.1-0.4	Nontoxic
S, %	<0.1	0.1-0.3	Nontoxic
Fe, ppm	<50	50-250	Nontoxic
Zn, ppm	15-20	20-100	>400
Mn, ppm	10-20	20-300	>300
Cu, ppm	3.5	5-20	>20
B, ppm	<10	10-100	>100
Mo, ppm	<0.1	0.1-0.5	>0.5
Cl, %	<0.2	0.2-2.0	>2.0
Si, %	<0.2	0.2-2.0	Nontoxic
Na, %	<1.0	1.0-10	Nontoxic
Co, ppm	<0.2	0.2-0.5	>0.5
V, ppm	<0.2	0.2-0.5	>1

[a] Data are from numerous references and numerous analyses based on the author's professional experiences. Levels of nutrients in certain crops can range to higher levels without toxicities. For example, the sufficient range for S is for grains and legumes, whereas the values for crucifers are generally 3 to 5 times greater.

[b] Nutrients listed as nontoxic, when in excess, may cause imbalances and detrimentally affect growth, but they are seldom toxic.

Piece-Rate Pay or Hourly Wages: A Question Concerning Many Vegetable Producers

By Dr. Frank J. Dainello, Extension Horticulturist - Commercial Vegetable Crops, Texas A&M University

Which type of pay system to use for compensating farm workers is an ongoing debate in the vegetable industry: piece rate or hourly wage. There are both pros and cons for each system. However, according to Gregory Encina Billikopf, area Labor Management Farm Advisor, Stanislaus County, California, University of California Cooperative Extension, when properly managed, piece-rate pay can result in enhanced wages for crew workers and increased productivity for growers. These gains are not always achieved, however. Many farm employers are concerned that quality suffers when workers are paid by the piece. Quality concerns can be overcome, but other challenges remain. Why is it, for instance, that some workers do not seem motivated by piece-rate work? What effect does worker attitude have on productivity?

In an attempt to determine both growers' and crew workers' feelings toward piece-rate pay, Billikopf conducted 2 separate studies. In the first study, a survey instrument was used to collect data from 40 vegetable growers. In the second study, 211 crew workers were interviewed in on-farm vegetable operations.

Findings of the studies suggest that crew workers were evenly split between those who preferred hourly pay and those who preferred piece-rate pay, the most common incentive used with crew workers. This result seems at odds with a grower feeling that workers generally seem pleased with incentives. But it certainly helps explain why, after poor-quality work, the next 2 top concerns of growers who try to motivate employees through incentives are (1) seeing no change in worker performance, and (2) difficulty in setting standards. These factors are closely related. Workers are hesitant to give their all when they fear that piece rates are not firm.

Farm employers have a challenge in setting fair rates when crop conditions are so variable from year to year. Employers who fail to do their homework in setting piece rates sometimes ask workers to go ahead and work for a piece rate that will be announced later, or have workers perform by the hour for a couple of days and then set the piece rate. In either case, workers soon learn that the faster they perform during these initial periods, the lower the pay for work performed.

At times, employers make a mistake in setting pay standards, and end up paying more than they think they should. Some have reduced the piece rates at this point. In doing so, they lose employees' trust and make workers hold back, fearful that superior performance will bring down their wages -- if not immediately, maybe next season. Other employers set piece rates that are too low to begin with, so crew workers don't think the work is worth their effort.

The main reason workers prefer piece-rate pay is a desire to get the work done quicker and earn more. Crew workers reported that when they are paid by the hour, some supervisors constantly push for faster work, expecting piece-rate effort for hourly pay. The word *carrilla* (slang derived from the Spanish words *carrera*, race, and *correr*, run) was often employed to describe this pressure for faster work. Some growers use 'rabbits', i.e., they pay a couple of workers under the table to work faster in an effort to get more out of an hourly crew without having to pay more.

The two main reasons that some workers prefer hourly pay are to avoid the games associated with piece-rate pay and a preference for the slower-paced hourly working conditions. Laboring by the hour can be substantially calmer, and offers breaks. Although in theory piece-rate workers can take a break whenever they want, in practice workers often forego their break because they are not compensated for break time. A third reason for preferring hourly pay is to obtain other benefits associated with hourly pay.

Mr. Billikopf offers the following recommendations to farm employers who would like to consistently achieve higher worker motivation under piece-rate pay:

- Think more in terms of how much it should cost to do a job, rather than how much to pay a worker per hour. In a properly constructed incentive pay system, the more the worker earns, the better off the employer is.
- Set standards carefully and inform workers ahead of time of the piece rate. Fair piece-rate formulas can be developed, taking into consideration crop density and, where records exist, labor costs.
- Once the pay level is set, it should not be reduced.
- Provide training and performance appraisal early on when workers change from one task to another. Even better, crew workers should earn the right to work on piece rate when they have proven their full understanding of expected quality, and not before.
- Add quality incentives to piece-rate pay to reward employees who consistently achieve high quality. Additional training or discipline can be implemented when employees consistently perform below quality standards.
- Where weather and crop conditions permit, hire fewer workers so the working season can be extended.
- Encourage workers to take breaks. This may take some creativity, such as bringing in warm bread or cold sodas to workers.
- Make sure that workers are paid regularly.
- Consider offering health insurance for year-round employees, whether they are paid on an hourly or a piece-rate basis.
- Where possible, provide hourly paid jobs for workers who prefer hourly pay over piece-rate pay.

From the article "Crew Workers Split Between Hourly and Piece-rate Pay" appearing in California Agriculture, Vol. 50(6):5-8.

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