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TO: Hormone File

FROM: J. H. Stoller

SUBJECT: The Hormonal Rhythm of a Pineapple Plant

STAGE #1 Vegetative Growth

The vegetative growth characteristics of the plant are directly related to the balance of IAA:cytokinin at the root tips. The signal is in the root cap of every root. This signal determines the proper ratio.

If the ratio of cytokinin (caused by nitrogen and moisture) is very high at the growing points, the roots force the plant to put out new leaves. The new leaves then supply the IAA to the roots in order to get more cell division in their meristematic tissue.

On the other hand, if the level of IAA in the roots is high, the roots tell the new meristematic growth on the upper part of the plant to slow down.

As can be seen from above, the manipulation of plant growth is merely a manipulation of the concentration for the two hormones, IAA and cytokinin. This represents a very interesting method of managing growth.

If one wants the pineapples to grow like they do in Hawaii, higher levels of IAA are necessary in the root zone. This will result in shorter internode length. It will also result in slower emergence of new leaves. Perhaps it will take the pineapple plant a longer period of time to reach the 2.5 kilos per plant. The plant, however, will be in better condition to bare larger fruit with less internal physiological disorders.

On the other hand, if one desires a very rapid growth of the plant so that it reaches 2.5 kilo weight more quickly, one would over supply cytokinin to the root zone so that more new leaves are forced out of the plant more quickly.

When considering the above, one must note that the more rapidly growing plant, for which the roots demand more IAA, will be a plant that is more susceptible to disease. Therefore, one can readily see that by forcing the plant to make more rapid growth, it will predispose the plant to a higher level of disease.

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The above procedure can be readily applied to any pineapple plant from 60 days after transplanting until forcing of the flowers. The small plant, which has just been transplanted, will now have sufficient root growth to enable the plant to push top growth. Therefore, the transplant should have both IAA and cytokinin applied in the proper ratio in order to encourage plant growth and recover from the transplant shock. These small plants are also more susceptible to herbicide damage.

Treatment Rates:

1. In order to force more top growth and achieve faster plant weight gain, apply 1 pint per acre of X-Cyte, along with 5 gallons per acre of Nitro Plus. This application should be made twice during the period. These materials can be mixed with the fertilizer applications. Therefore, there will be no need to make an extra trip over the field.
2. If shorter internode length is desired, apply 5 oz. per acre of Satisfy (Stimulate) twice per period. This can also be mixed with the regular fertilizer application.

By manipulating the above two treatments, one should be able to control the way the plant grows.

For the young transplants, 6 oz. per acre of Satisfy (Stimulate) should be applied to the young crop at the time of planting. This treatment should continue twice per period until the young plant is 2 periods of age.

If one wants to quickly force a new bud, which is close to the soil surface, it is recommended that an extremely high dose of X-Cyte is used for this process of forcing the new bud, which will represent the ratoon crop. By raising the level of cytokinin ratio to IAA, the roots are going to demand more IAA than the new growing tissue on top of the plant can furnish them. Therefore, the roots are going to insist that the new bud be formed in order to generate more IAA. It is best to do this application before the pineapple plant goes into its rapid growth stage. By doing so, the plant will not be able to put out leaves fast enough to fulfill the IAA requirement of the roots. In Hawaii, where there are cooler temperatures, the roots automatically have an abundance of cytokinin:IAA. This is why the buds are forced out earlier and closer to the soil surface.

#2 Preflowering

One needs to avoid the problem of preflowering. This condition is normally caused when the plant is not transporting IAA from the new tissue down to the bud in sufficient quantities in order to maintain the bud in a vegetative stage of growth. This normally happens during stress periods, when the plant is not able to produce sufficient quantities of IAA in the new apical meristem tissues.

In order to avoid the problem of preflowering, high levels of cytokinin need to be applied to the plant in order to force more IAA movement from new leaf growth down through the budding point. The easiest way to do this is through the application of Bio-Forge (a super cytokinin). An application of approximately 4 liters per acre during this period of preflowering should be able to control the problem of preflowering.

When growing pineapple in Latin America or the Philippines, the problem of preflowering is normally more severe when temperatures cool after a prolonged period of hot temperatures. In this case, Bio-Forge should be applied to the plant at least 48 hours before the temperature change occurs.

#3 Forcing of Flowers

The forcing of flowers is accomplished by applying the chemical that forms ethylene in the plant. The reason that ethylene changes the bud from vegetative to reproductive is because ethylene is the hormone that inhibits IAA transport from the apical meristem tissue down to the bud. During periods when apical meristem tissue is excessively growing, it is more difficult to force the pineapple bud change, from vegetative to reproductive, by using ethylene. Because of this, I would suggest the use of cytokinin along with the ethylene spray. Perhaps the use of Bio-Forge would even be superior to the use of X-Cyte.

#4 Post Flowering

During the period of post flowering, the first 14 weeks is usually the period of cell division. The cell division will be directly proportional to the strength of the flowers and their ability to initiate and divide cellular growth over this 14 week period.

Many people believe that cell division is only a function of cytokinin. This is a mistake. Cell division is a function of both IAA and cytokinin. During stress conditions, flowers are normally deficient in IAA. Therefore, a combination of IAA and cytokinin should be used during this period of cell division, particularly during the first 4 weeks after flowering. If the use of cytokinin only is desirable, it would be from the last 10 weeks of cell division, not the first 4 weeks.

RECOMMENDATION

Apply 5 ounces per acre of Stimulate (Satisfy) twice per period after flower initiation along with 5 gallons of Nitro Plus per acre. This should be continued for at least the first 4 weeks after flower appearance.

From the 5th to the 14th week, one pint per acre of X-Cyte can be applied twice per period. This may be continued until 14 weeks after flower initiation.

The above should give us ample cell division in order to maintain the best yield, quality, and fruit sizing for the pineapple.

STAGE #5 Cell Sizing

Cell sizing can be accomplished by the use of N-Large. This gibberellic acid can be applied at the 14th week after flowering. The application rate would be approximately 200 ppm of active ingredient to 400 ppm of active ingredient. If the lower rate is used, perhaps an additional treatment should be applied during the 18th week after flowering.

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A single application for the above would be 9 liters per hectare of N-Large at 14 weeks after flowering.

The literature often states that the effectiveness of GA on cell sizing is directly related to the amount of cytokinin in the cells. It may be of great value to add 1 pint of X-Cyte twice per period beginning at the period of 14 weeks after forcing through the 18th week.

The above should result in a large fruit, because all cells will become larger. It should also result in a more cylindrical shape fruit. One must be careful, however, not to over apply, as it could result in the reduction of some of the desirable fruit characteristics.

The above treatment will probably delay color change approximately 7 days. This is desirable from the standpoint resulting in a greater number of days for fruit sizing.

Following are the characteristics of the products that are recommended for the above uses.

Stimulate and Satisfy:

These products are a combination of auxins and cytokinins. They are more heavily weighted in their context toward auxin.

X-Cyte:

X-Cyte is a pure cytokinin product. There are no micronutrients or other nutrients in this product. There are no other hormones in this product.

Bio-Forge:

Bio-Forge is made from a compound called urea diformate. This product has the activity of a super cytokinin when applied to a plant.

N-Large:

N-Large is a formulation of GA₃. It has the same characteristics as Pro Gibb at the same concentration of solution. It is more economical than Pro Gibb.

The above information represents the most recent information that is available to our company. Some of the above information has already been tested on alternative crops and is very effective for the use stated above.

While making the above statement, the company realizes that pineapple grows in a different manner to some other agronomic and horticultural crops. From a hormonal standpoint, however, there is a great similarity of response. As we increase our databank on the use of hormones, I'm sure that there will be other items for consideration.