NITROGEN FERTILIZATION OF CRANBERRIES: WHAT TYPE SHOULD I USE, HOW SHOULD I APPLY IT, AND WHERE IS MY NITROGEN FROM LAST SEASON?

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The potential yield of cranberry plants is closely related to plant nutrition. Of the essential plant nutrients, nitrogen has the greatest impact on plant growth and yield. An adequate supply of nitrogen contributes to proper development, flowering, and productivity of the cranberry plant. Excessive nitrogen uptake will enhance vegetative growth and reduce fruit yield, while inadequate nitrogen uptake will decrease plant vigor and also reduce yield.

Most nitrogen fertilizers are applied as a granular with a boom or as a liquid through irrigation systems. However, some nitrogen is routinely applied as a foliar mist to increase nitrogen content in the upright. Although many research studies have been completed to determine which type of fertilizer may be best suited for cranberries, determining "what" and "how much" the plant is taking up is very difficult. Recently researchers have used an accurate yet expensive technique to determine what type of nitrogen fertilizer the cranberry is utilizing. In an effort to better understand the nitrogen requirements of cranberries, many tests were conducted using this technique. The following results are the most recent and conclusive evidence regarding nitrogen nutrition in cranberries.

SUPPLEMENTAL FOLIAR NITROGEN APPLICATIONS

In previous years many growers have begun using foliar nitrogen products to supplement their existing fertilization program. A series of experiments were conducted on test plots in producing fields to understand the importance of supplemental foliar nitrogen application. In this study, we applied three forms of nitrogen (urea, ammonium, and nitrate) to the cranberry plants every week from early June to mid-July. A total of 3 lb. of nitrogen was applied per acre. The grower applied 40 lb. per acre of granular nitrogen to these plots that season.

Very high percentages of the foliar nitrogen was absorbed by the cranberry shoots (Figure 1). 77% of the Foliar applied urea was recovered in the shoot, and significant levels of both ammonium and nitrate were also absorbed. This study shows that cranberry plants will absorb foliar applied nitrogen at relatively high percentages.

To determine where the absorbed foliar nitrogen was located in the shoot, shoots were separated into uprights, stems, fruit, and leaves (Figure 2). In this seminar, uprights are defined as the current seasons' growth. Stems constitute all old stem material above the soil surface, and leaves are the old leaves from the previous year. Most of the foliar nitrogen was found in equal percentages in both the uprights and stems. Only 8% to 10% of the foliar nitrogen was found in the fruit. This is surprising, because the nitrogen applications were applied during bloom and fruit

set, when supposedly nitrogen was limiting to the fruit. However urea and nitrate fertilizers were in slightly higher concentrations in the uprights than stems, while the majority of ammonium nitrogen was in the stem.

Although up to 77% of the foliar applied nitrogen was recovered by the cranberry plant, the actual quantity of nitrogen absorbed was not very significant (Figure 3). The cranberry plant received 40 lb. of granular nitrogen through the root system. And given the large reserve of nitrogen in the shoot, the 3 lb. of supplemental foliar nitrogen applied to the plant only increased the plants' total nitrogen supply by 3 percent. Some growers feel that a supplemental fertilizer application at bloom and fruit set will improve fruit set and yields. Visually, the foliar nitrogen on cranberries gave the vines a greener appearance than other vines in the bed. Likewise, the upright tissue nitrogen concentration increased from 0.95% to 1.00% because of the foliar fertilizer. However, yields, fruit set, and berry weight were not influenced by supplemental nitrogen applications. The amount of foliar nitrogen found in the fruit was barely detectable, which suggests that use of supplemental nitrogen for increased fruit yields is not true.

FOLIAR AND SOIL APPLIED NITROGEN

Another question asked by growers concerning foliar applications is: Is there a benefit to applying all foliar materials instead of soil applied nitrogen. The answer to this question was addressed. Foliar urea and foliar nitrate fertilizers were supplied to plants at 20 lb. per acre (Foliar applied ammonium fertilizers at this rate would kill cranberry plants). They were compared to soil applied urea, ammonium, or nitrate nitrogen also at 20 lb. per acre. The results are presented on Figure 4. More nitrogen was recovered from foliar fertilizers than soil applied fertilizers. The higher concentration of foliar urea and foliar nitrate resulted in a 58% to 62% recovery. Soil applied nitrogen treatments averaged 40% to 45%, with urea and ammonium performing the best, Surprisingly, it appears that nitrate nitrogen is also absorbed by cranberry plant roots. However, we are not sure if microbes or mycorrhizae are converting the nitrate to ammonium before the plant takes it up, or if cranberries actually use nitrate.

To get nitrogen predominantly to the upright, both foliar applied urea and nitrate worked equally well (Figure 5). Lesser percentages of soil applied nitrogen also were found in the upright. In particular, nitrogen from urea and ammonium were found in greater percentages in the stem. Very little nitrogen was found in the fruit and old leaves.

Figure 6 shows the quantity and location of the foliar applied nitrogen in the shoot. Approximately 33% of the total nitrogen in the uprights and fruit came from the current seasons' nitrogen application. This was typical for the other fertilizers also. The stems, which have many years of nitrogen reserves also received a substantial quantity. These results show that current seasons' nitrogen application only contribute partially to the nitrogen supply needed.

WHERE IS THE NITROGEN FERTILIZER FROM LAST YEAR?

The big question with nitrogen nutrition in a perennial crop is: How much of last year's fertilizers are found in this year's uprights and fruit? Figure 7 shows how much of the original 20 lb. N/acre

was found the first season, then the next season. Overall, 30 to 50% of last years fertilizer was found in the current season's cranberry shoot. Nitrogen after the second season was located primarily in the stem, probably as storage (Figure 8). Very little nitrogen was found in last year's leaves and fruits. Because so little nitrogen was found in the fruit in consecutive years, the cranberry plant must use previously stored nitrogen forms for its fruit production. The actual quantity of last season's nitrogen found in this season's shoot is depicted in figure 9. Uprights contained only 8% of last season's nitrogen, and the fruit contained significantly less. It is safe to assume that the nitrogen in the uprights and fruit will be detected in small amounts for many years to come.

CONCLUSION

As you learn more about nitrogen fertilizer use from this seminar, it is important to understand that we still do not know everything about the use of nitrate nitrogen by cranberry plants. Some studies conducted in the greenhouse showed that cranberry plants used ammonium fertilizers up to 10 times faster than nitrate. If only nitrate was supplied to the roots, the plant could not absorb it: ammonium had to be there also. Likewise the use of nitrate nitrogen could also raise your soil pH and lead to more serious complications. To date, it is still best to use urea and ammonium fertilizers, but this research shows that nitrate is not a detriment to cranberry production.

PERCENT FOLIAR N RECOVERED IN SHOOT
Nitrogen applied at 3 lb / acre

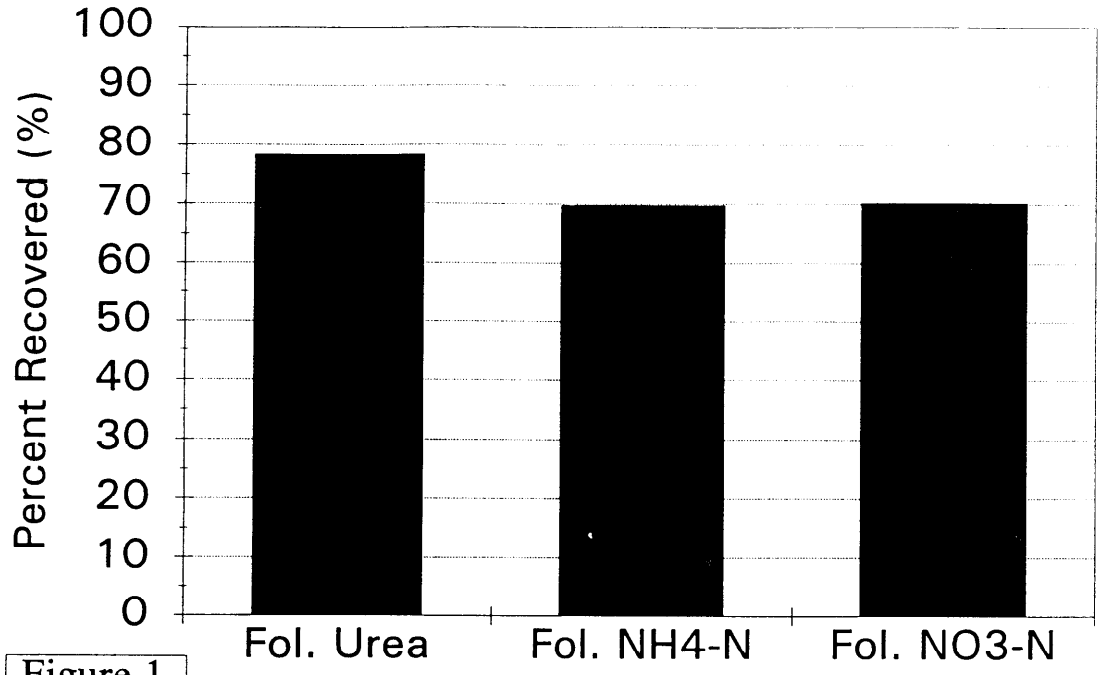

Figure 1

DISTRIBUTION OF FOLIAR NITROGEN IN THE SHOOT - N applied at 3 lb / A

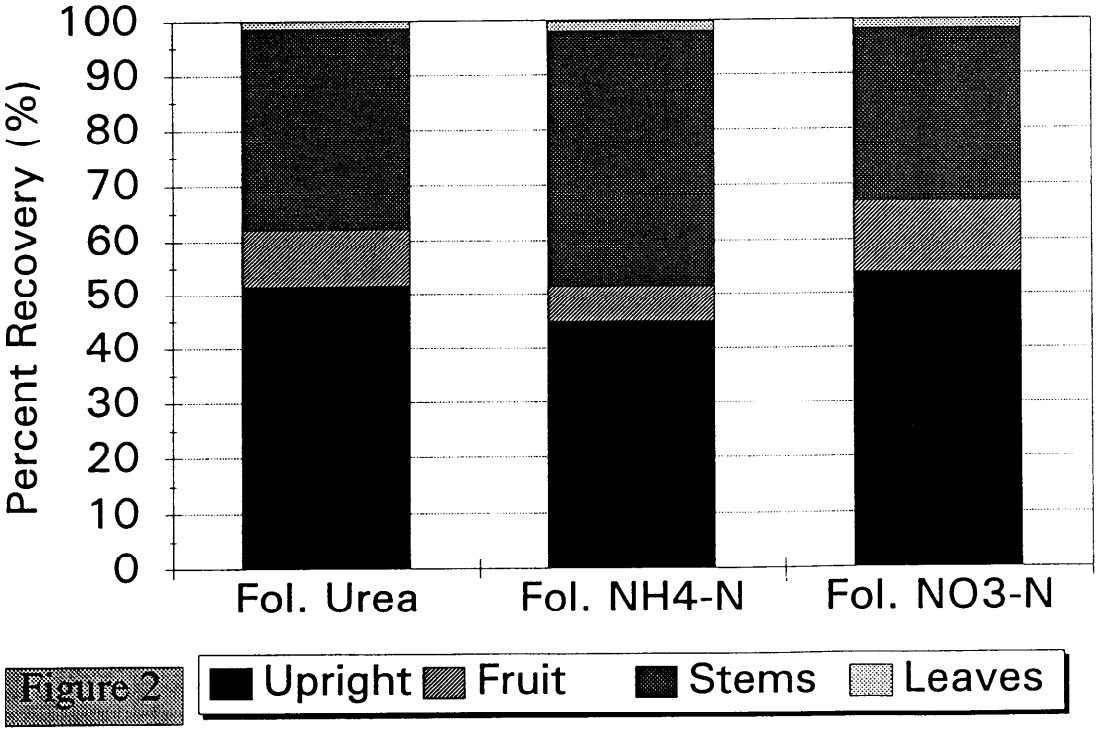

Figure 2

QUANTITY OF FOLIAR UREA RECOVERED IN SHOOTS - N applied at 3 lb / A

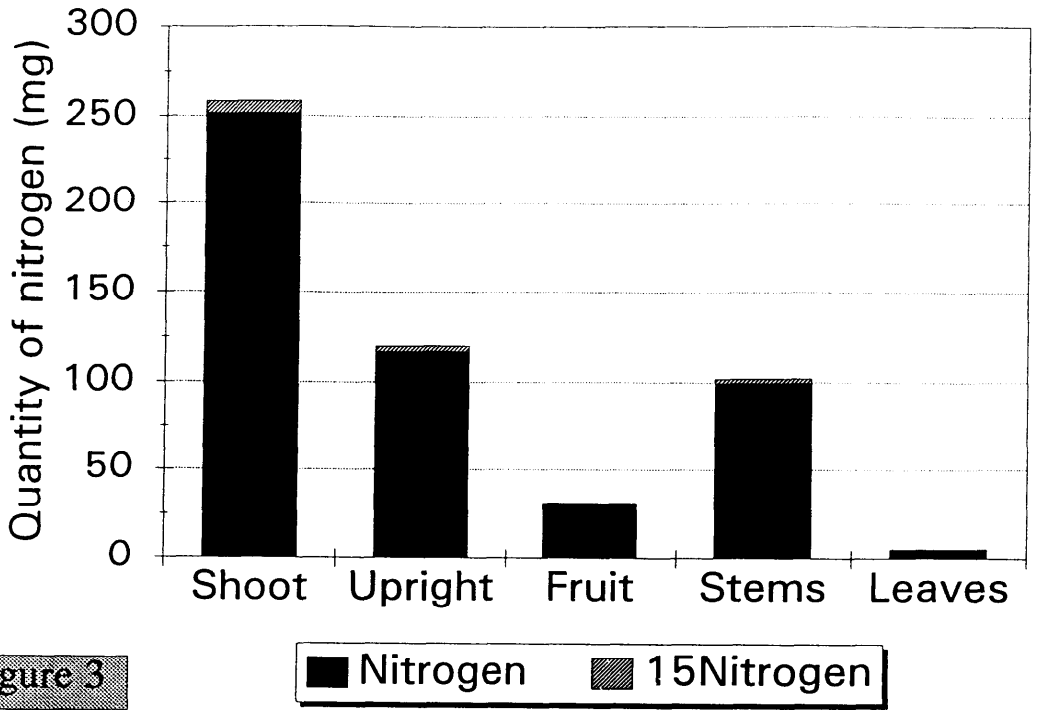

Figure 3

PERCENT NITROGEN RECOVERED IN SHOOT Nitrogen applied at 20 lb/A - YEAR 1

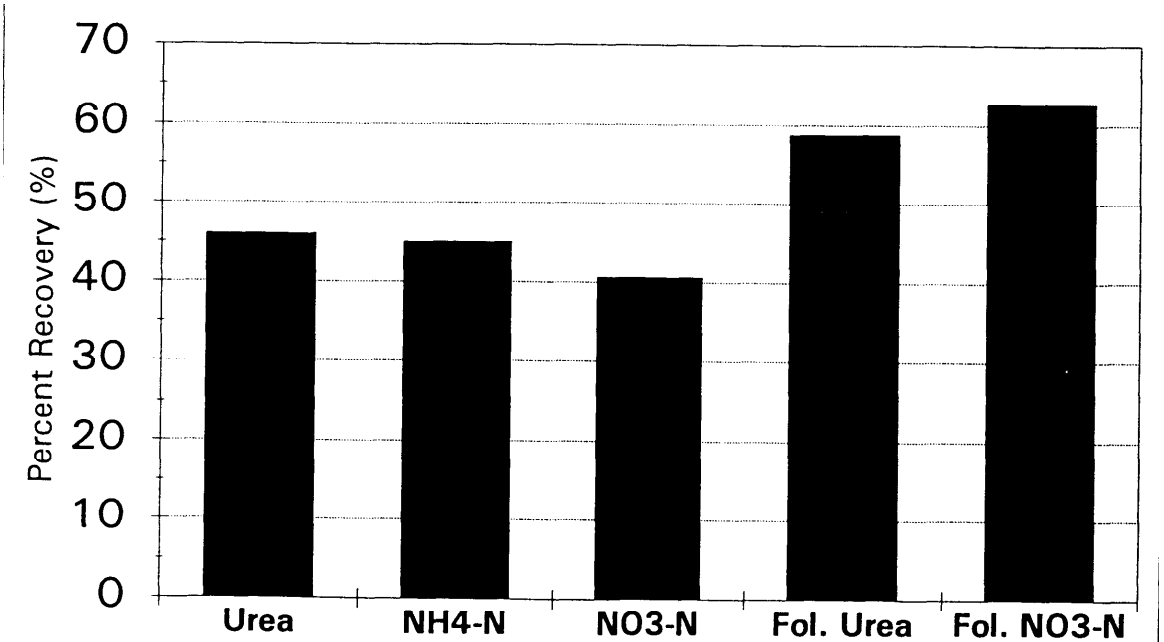

Figure 4

DISTRIBUTION OF FOLIAR NITROGEN IN THE SHOOT - N applied at 20 lb/A - year 1

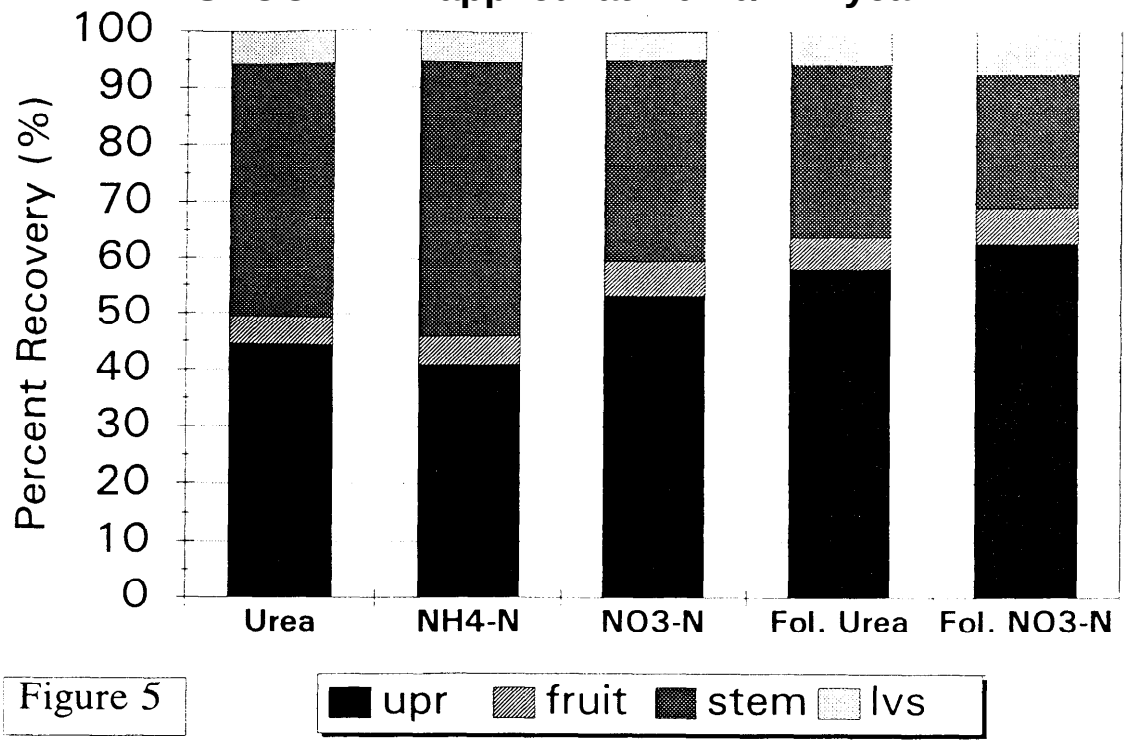

Figure 5

QUANTITY OF FOLIAR UREA RECOVERED IN SHOOTS - N applied at 20 lb/A - year 1

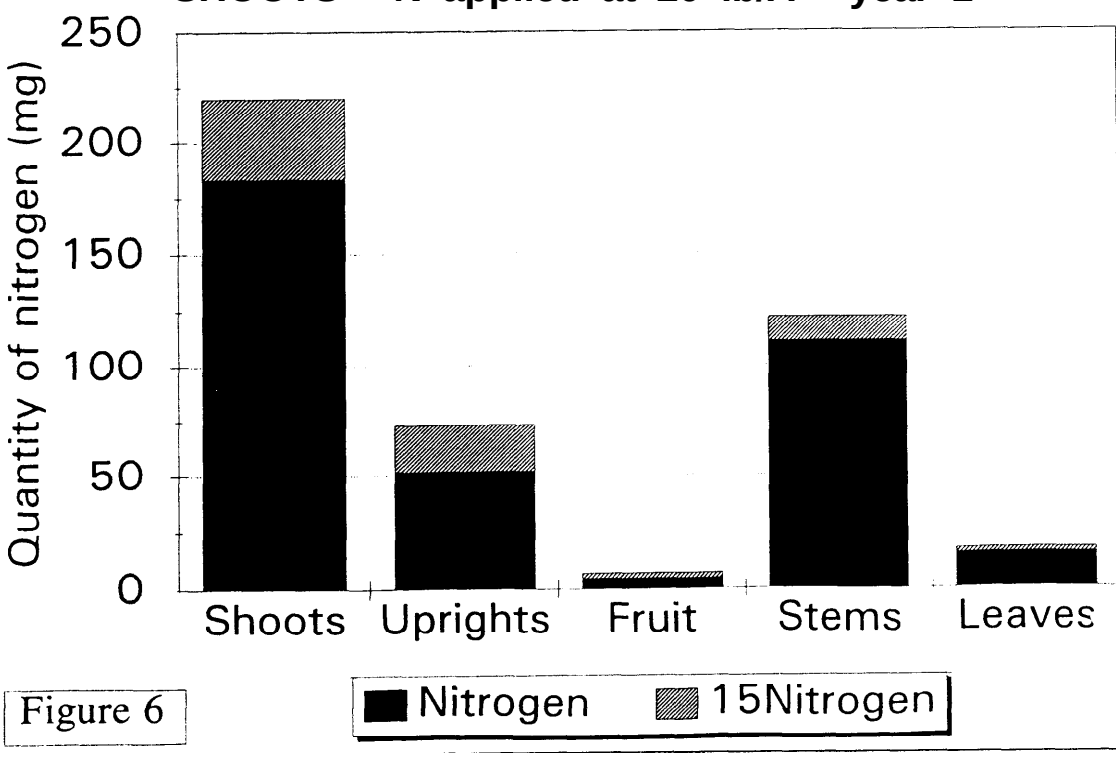

Figure 6

PERCENT NITROGEN RECOVERED IN SHOOT

Nitrogen applied at 20 lb/A

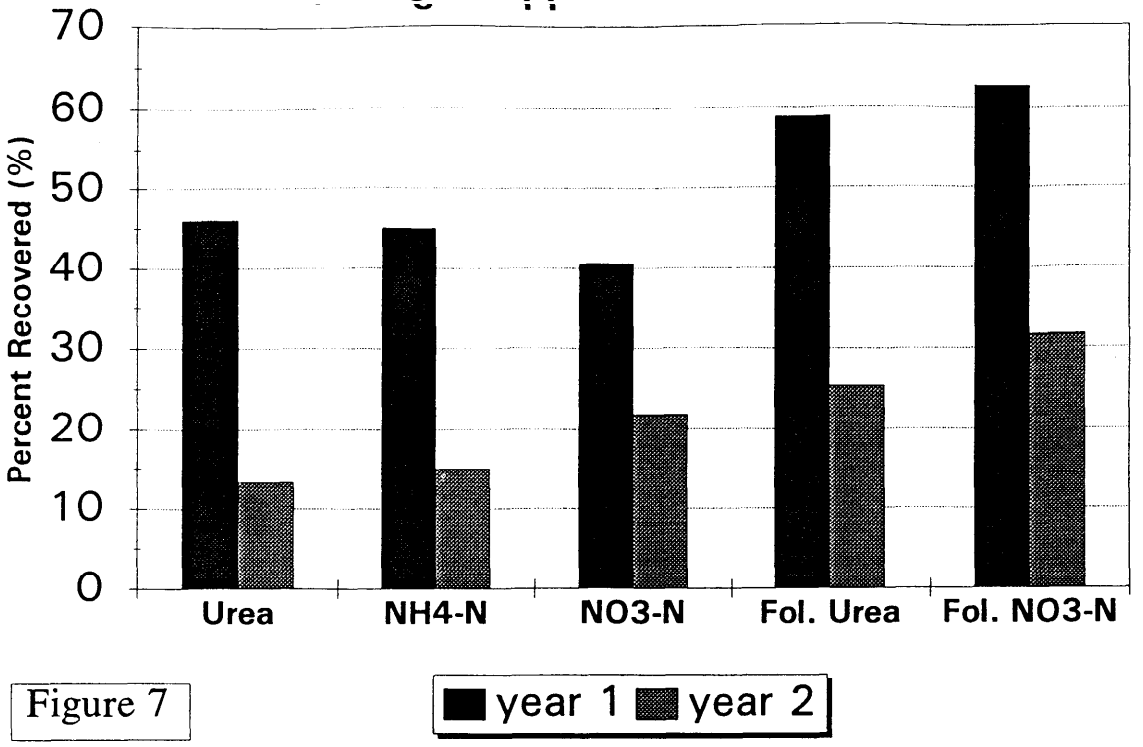

Figure 7

DISTRIBUTION OF FOLIAR NITROGEN IN THE SHOOT - N applied at 20 lb/A - year 2

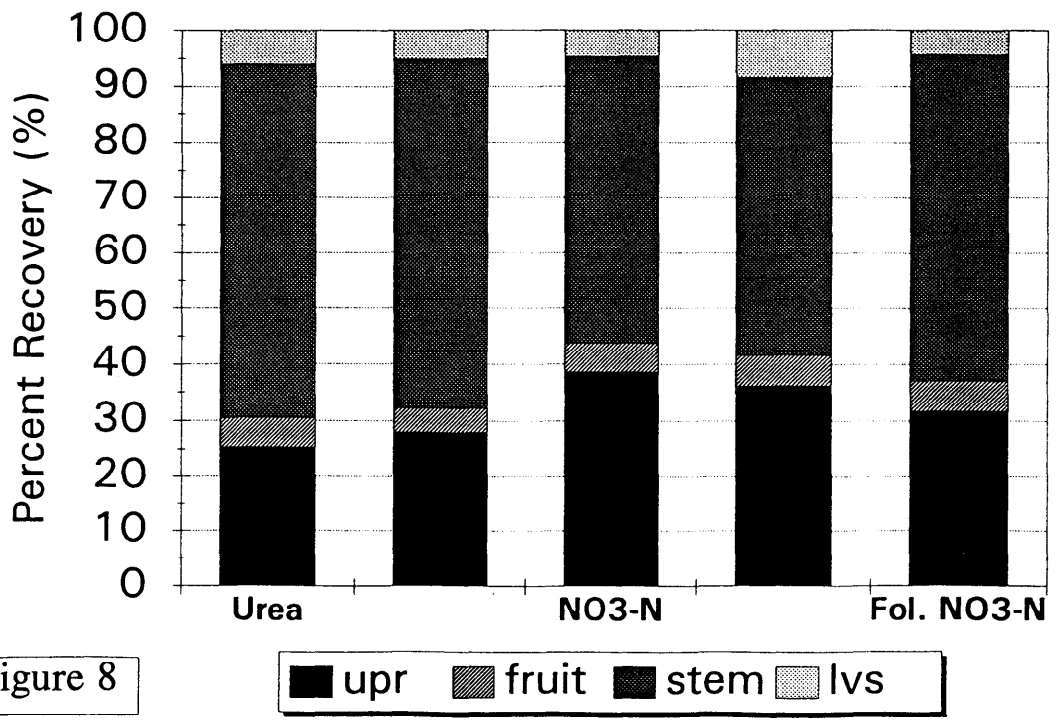

Figure 8

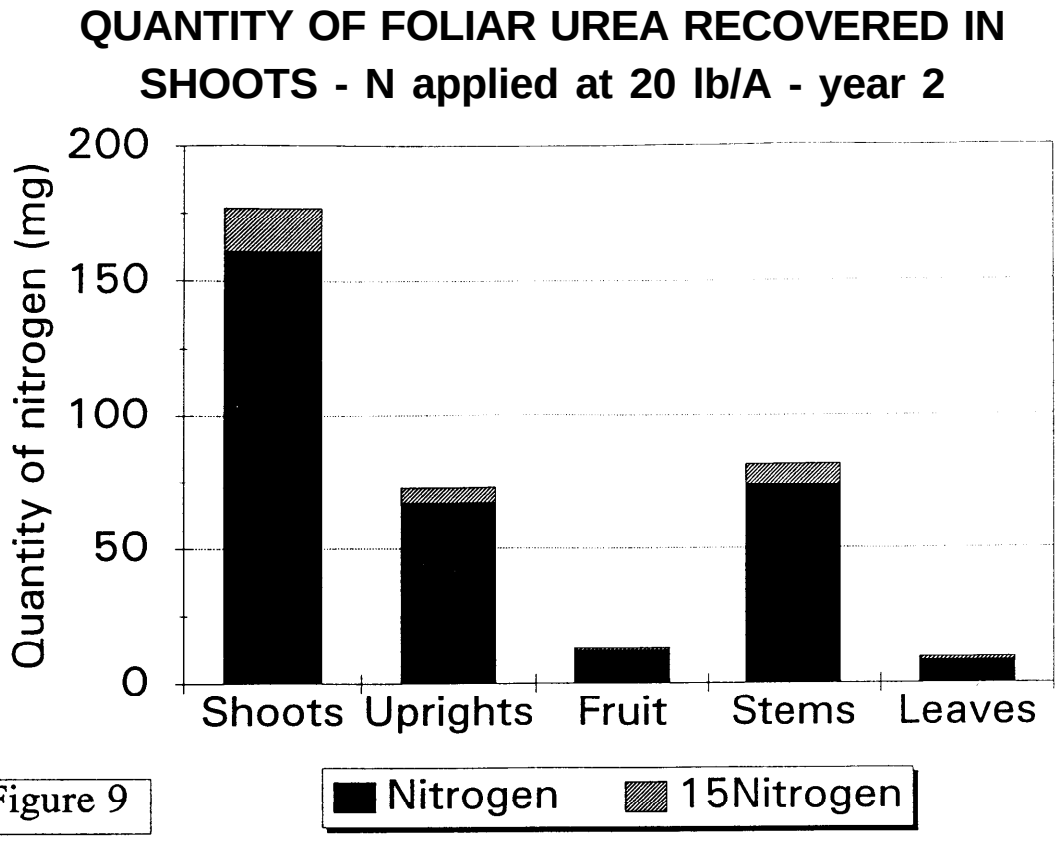
QUANTITY OF FOLIAR UREA RECOVERED IN SHOOTS - N applied at 20 lb/A - year 2
Quantity of nitrogen (mg)
200
150
100
50
0
Shoots
Uprights
Fruit
Stems
Leaves
Nitrogen
15Nitrogen

Figure 9