# Yellow berry of wheat linked to protein content


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*Decreased yellow berry—a disorder of Cocorit durum wheat—was associated with increased protein content, which, in turn, was affected by nitrogen and irrigation applications.*


Durum, a wheat used in macaroni and spaghetti products, is milled to coarse granular middlings called semolina, unlike bread wheat, which is milled to flour. Nearly 60 percent of the wheat-producing area of the Imperial Valley was converted to durum in 1976 to benefit from the higher price paid for this type of wheat.

One variety, Cocorit, was previously shown to be highly susceptible to a disorder causing the production of an undesirable off-color grain called yellow berry. Successive price penalties are levied on growers for lots containing 25 percent and 40 percent yellow berry. Agronomists had associated the formation of yellow berry with the timing of irrigation and nitrogen application, and this theory was investigated.

## Procedure

One hundred forty-four plots were established on a fertile, well-drained Imperial clay soil, divided into 12 blocks for separate irrigation. The 12 blocks were grouped in pairs to provide six replications of a split-plot design. Half received six irrigations, and the other half received seven.

In the wetter of the two irrigation treatments, the soil was irrigated when it reached a tension of 7.5 bars in the top 30 cm. The drier treatment was irrigated after the top 30 cm had reached 15 bars tension. Just before harvest, on May 28, 1976, the wet treatment still retained 10.5 cm, and the dry 7.2 cm.

Nitrogen treatments were applied as shown in the table. Percentages of protein and yellow berry were determined on grain harvested from each treatment.

NITROGEN TREATMENTS, PREPLANT AND AT TWO GROWTH STAGES OF DURUM WHEAT

| Treatment number | Nitrogen applications at: | | |
|---|---|---|---|
| | Preplant | Tillering | Boot |
| | *kilograms per hectare* | | |
| 1 | 0 | 0 | 0 |
| 2 | 134 | 0 | 0 |
| 3 | 67 | 67 | 0 |
| 4 | 45 | 45 | 45 |
| 5 | 202 | 0 | 0 |
| 6 | 101 | 101 | 0 |
| 7 | 67 | 67 | 67 |
| 8 | 270 | 0 | 0 |
| 9 | 135 | 135 | 0 |
| 10 | 90 | 90 | 90 |
| 11 | 404 | 0 | 0 |
| 12 | 135 | 135 | 135 |

## Results and discussion

Figure 1 shows the percentage of yellow berry distribution. Of the four treatments with less than 25 percent yellow berry, three had included applications at preplant, tillering, and boot stages.

The percentage of protein in the treatments showed nearly the same sequence as the yellow berry (fig. 2). For each increase of 1 percent protein, the yellow berry had decreased by 23.8 percent. These data clearly indicate the advantage of splitting nitrogen applications to meet plant needs at the boot stage.

Half of the 12 treatments fell within a yield range of 8.48 to 7.99 tons per hectare and were not significantly different. Only two of these six treatments (7 and 10) also fell in the group with the lowest percentage of yellow berry.

Figure 3 shows treatment influence on yield. Yield was highest from the three-way split of the lowest amount of nitrogen applied—134 kilograms per hectare (kg/ha). Unfortunately, this amount applied in this way also produced protein levels associated with more than 25 percent yellow berry. The increase to 202 kg/ha, divided into thirds, also produced a high yield. Increasing nitrogen beyond 202 kg/ha did not increase yield, regardless of the division of applications. The highest rate—404 kg/ha—produced a significantly lower yield in both treatments. Yield produced by three 90-kg/ha applications was not significantly lower than that produced by three 67-kg/ha applications. The trend in figure 3 suggests that yields were beginning to drop with the triple-division applications at the 270-kg/ha level.

The two irrigation treatments produced significantly different protein percentages with the consequent yellow berry percentages. The seven irrigation applications that allowed soil moisture tension to reach only 7.5 bars in the surface 30 cm of soil produced significantly lower protein and more yellow berry than the treatment that produced a tension of 15 bars in the surface 30 cm. The wetter irrigation treatment probably produced significantly lower protein and greater yellow berry, because the additional water increased nitrate leaching.

Photo above shows hard amber durum grains on left and yellow berry on right.

## Conclusions

Yellow berry in Cocorit durum wheat is closely associated with protein percentage in the grain; an increase of 1 percent protein reduced yellow berry by 23.8 percent. Protein content, in turn, is affected by nitrogen and irrigation treatments. Nitrogen at 202 or 270 kg/ha, split in three equal applications at preplant, tillering, and boot stage, produced the best yields among treatments that resulted in less than 25 percent yellow berry. The drier six-irrigation treatment produced higher protein and less yellow berry than the seven-irrigation treatment.

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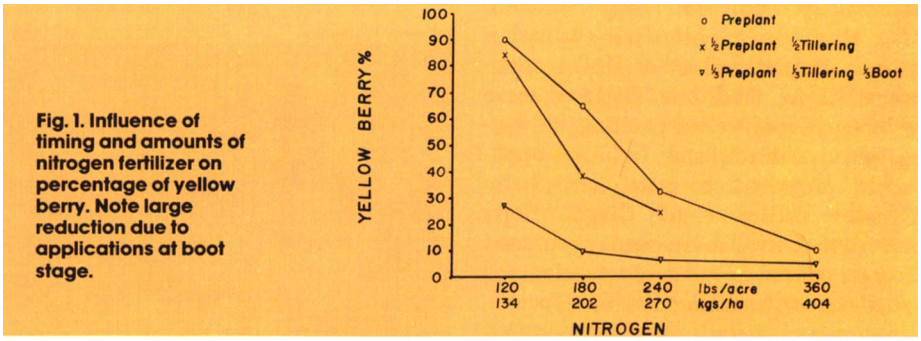


Fig. 1. Influence of timing and amounts of nitrogen fertilizer on percentage of yellow berry. Note large reduction due to applications at boot stage.

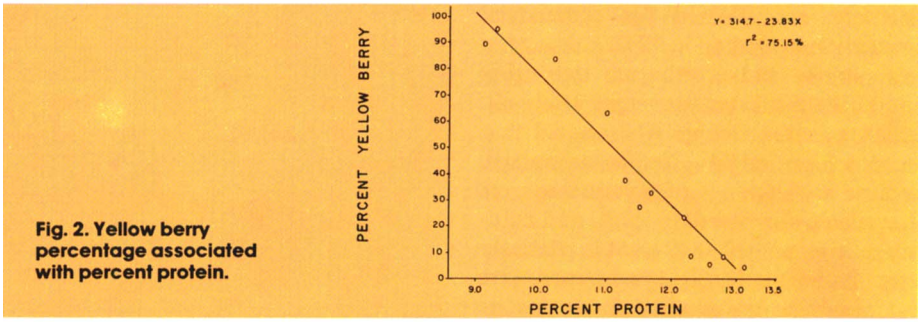


Fig. 2. Yellow berry percentage associated with percent protein.

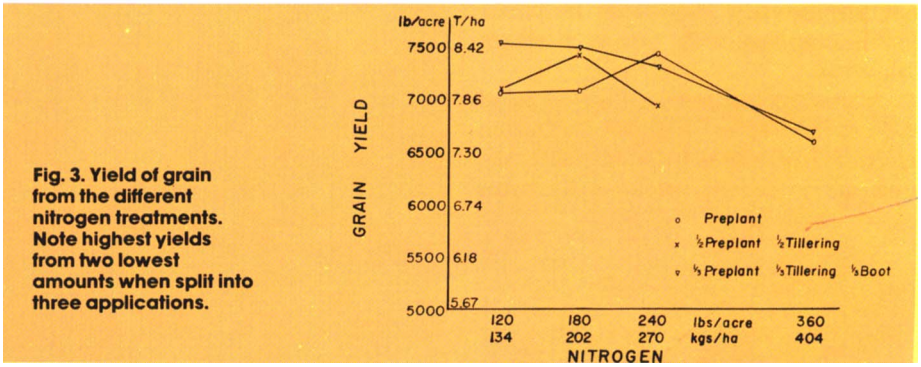


Fig. 3. Yield of grain from the different nitrogen treatments. Note highest yields from two lowest amounts when split into three applications.