A REVISED VERSION OF COTMAP FOR MAPPING COTTON PLANTS

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Abstract

Due to its indeterminate growth habit and multiple fruiting sites, plant map data of cotton (*Gossypium hirsutum* L.) are difficult to collect and interpret; however, such data is valuable for describing genetic variation and explaining variations in yield among genotypes or production practices. The COTMAP program (Watson and Bourland, 1989) was developed as a tool to aid research scientists in the summarization and analysis of plant mapping data for cotton. The COTMAP technique requires individual mapping of the first and second sympodial positions; however, other fruiting sites are measured collectively in three categories: 1) bolls on outer (> position 2) sympodial nodes, 2) bolls on sympodia arising from monopodia, and 3) bolls on secondary axillary (either on main stem or sympodial nodes) positions (Bourland and Watson, 1990). Plant height, number of monopodia, node number of the first sympodial branch and the highest sympodial branch with two nodes are also recorded to aid in the evaluation of plant structure. The concept is based on the relative importance of the first two sympodial positions. Several researchers have reported that 80 % or more of the yield of a cotton plant is produced on the first two sympodial nodes from the main axis (Kerby et al., 1987; Mauney, 1979 and 1986). This technique of mapping saves considerable time compared to mapping each fruiting site individually with little loss of information.

A revised version of the COTMAP program is currently under development for release in 1997 or early 1998. The original COTMAP program is capable of analyzing data from one or two factor experiments. One factor experiments may be either randomized complete block (RCB) or completely randomized (CRD) designs. Two factor tests may be arranged as a split-plot (RCB or CRD), split-block (RCB), or 2-way factorial (RCB or CRD). The revised version will also have the capability of analyzing three factor experiments in a RCB or CRD design with either a split-split plot or factorial treatment arrangement.

Data Collection

Data are generally collected at plant maturity but may be collected periodically throughout the season. Defoliation of leaves prior to data collection facilitates examination of mature plants, but is not essential.

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Each plant is examined for node number of the first (i.e. lowest) sympodial branch on the main axis (FN), number of monopodia (M), and accumulative bolls on sympodia arising from monopodia (MB). Sympodia associated with the main axis are then coded for occurrence of bolls in the first two positions using a scale of: 0 = no bolls (NB), 1 = boll in first position only (FB), 2 = boll in second position only (SB), and 3 = bolls in both positions (BB). The total number of bolls on the outer (>2) sympodial nodes from main axis (OB) of each plant are also recorded. The highest sympodium with two nodal positions (H2) is noted. Cumulative number of bolls on sympodia =arising from secondary axillary positions (XB) are generally low and can be counted after sympodia are coded. Finally, plant height (PHT) is measured as the distance from cotyledonary node to apex.

Variables Evaluated by COTMAP

Variables evaluated by the revised COTMAP can be partitioned into those relating to plant structure or yield.

Plant Structure Variables

FN = node number of first sympodium on main axis
M = number of monopodia on main axis
S = number of sympodia on main axis
ES = number of highest sympodium with a boll in the first position
H2 = number of highest sympodium with at least two nodal positions
TN = number of nodes on main axis above the cotyledonary node
PHT = distance from cotyledonary node to plant apex
IL = average distance between main axis nodes (= PHT / TN)

Yield Variables

TB = total number of bolls per plant
Boll distribution - % of TB associated with:
- First sympodial positions (%B1)
- Second sympodial positions (%B2)
- Outer sympodial positions (%OB)
- Sympodia arising from monopodia (%MB)
- Second axillary positions (%XB)

Boll retention, % of nodes with bolls in:
- First sympodial positions (BR1)
- Second sympodial positions (BR2)
- Early (first 5) sympodial positions (EBR).

Data Entry

The original version of COTMAP was programmed for on-screen data entry with treatment factors and replication in sequential order. The revised version will have the capacity to read externally-created (e.g. by use of data loggers, text editors, word processors, spreadsheets, etc.) space-delimited ASCII data files; however, an on-screen data entry routine

is still available. Using externally-created files offers two advantages: 1) it is easier to append data to existing files, and 2) plots can be entered in random order. An example of a data file format for three plants in a three factor experiment would be:

```
1  1  1 1  1  4 2 3 2 0 7 90 1202132101
1  1  1 1  2  5 1 2 3 1 8 88 2022021211
2  1  1 1  1  6 1 2 2 0 7 92 102202201
```

where the variables in each record (i.e. row) are from left to right: replication, level of factor A, level of factor B, level of factor C, plant number, FN, M, MB, OB, XB, H2, PHT, and the sympodial codes (entered as a continuous string of numbers).

Data Analysis

The program can perform analysis of variance and calculate all possible least significant differences. The summary data files created by COTMAP are stored as space-delimited ASCII files and can, consequently, be analyzed by other software packages such as SAS if so desired.

References

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