Exam III
Key
December 16, 2005
100 points possible

2 pts. 1.a) Average seed to seed spacing is $25 / 5 = 5$ inches.

\[
(1 \text{ seed} / 5 \text{ in.}) (12 \text{ in.} / \text{ ft.}) (17,424 \text{ ft.} / \text{ acre}) = 41,817.6 \text{ seeds/ acre}
\]

2 pts.  

\[
\begin{array}{ccc}
4 - 5 & = & 1 \\
2 - 5 & = & 3 \\
15 - 5 & = & 10 \\
3 - 5 & = & 2 \\
1 - 5 & = & 4 \\
\end{array}
\]

\[
x \quad x^2
\]

\[
\begin{array}{ccc}
1 & 1 \\
3 & 9 \\
100 & \\
4 & 16 \\
\end{array}
\]

\[
\text{Sum of squares of differences /r - 1} = \frac{130}{4} = 32.5 = S^2
\]

\[
S = 5.7 \text{ inches}
\]

2 pts. c) 3 bu / acre yield penalty for each inch of standard deviation greater than 2.

\[
5.7 - 2.0 = 3.7 \text{ inches of standard deviation greater than 2.}
\]

\[
(3.7)(3) = 11.1 \text{ bushels per acre potential yield penalty.}
\]

3 pts. 2. a) Scout the 2005 soybean field using sticky traps spaced at approximately 100 yard intervals (avoiding field borders). Traps should be in place during egg laying by corn rootworm beetles (at this latitude this occurs during July, August and September).

3 pts. b) The economic threshold indicating the need for soil insecticide at planting is an average of 5 beetles per trap per day (e.g. 35 or more beetles trapped over a seven day period).

3 pts. 3. a) Excavate the base of the stalk and split the stem. The node at the top of the first visibly elongated internode is leaf node 5. Count nodes upward from this reference node until a node is located with leaf still attached. Count further upward until the uppermost leaf node with collar visible is located (this defines the V stage).

3 pts. b) No free fluid easily expressed from kernels at mid ear.

First dents appearing at the base of the ear.

Cob pink (for hybrids which ultimately have a red cob).

4 pts. 4. Soybeans are the more drought tolerant crop.

6 pts. (3 points for each of two reasons)

a) Soybeans sustain their photosynthetic rate under a more negative leaf water potential (e.g. down to -11 bars vs. down to -4 bars for corn).

b) Soybeans flower over a much longer period (e.g. as long as 4 to 6 weeks for Soybeans vs. approximately 1 week for Corn). Soybeans are therefore able to compensate for stress during one part of flowering by retaining a higher percentage of flowers, pods, and seeds at times of lower stress.

c) Soybeans produce a much larger number of flowers than will ever be realized as pods).
d) Soybeans are a self-pollinating crop and are therefore less vulnerable to drought stress than corn which is open-pollinated.

4 pts. 5. a) Seed within 2 weeks after the Hessian Fly Free date for a given location.  
(The range of Hessian Fly Free Dates for Indiana is September 22 in the North through October 9 in the South.)

4 pts.  b) Seeding within 2 weeks after the Fly Free Date at a given location allows sufficient time for the crop to establish adequately to survive through the winter (too late means potentially extensive winter kill).

Seeding too late would expose the crop to egg laying by Hessian Fly and also may result in excessive Fall growth (which may lead to matted plants and the development of leaf diseases).

2 pts. 6. a) 25 to 30 plants/square foot

2 pts.  b) 144 in.² / 8 in. = 18 inches of row distance/square foot

2 pts.  c) (2 heads per plant) X (20 plants per square foot) X (1.6) = 64 bushels per acre

2 pts. 7. a) 40 + [(1.75) (100 Bu/Acre - 50)] = 127.5 Total Lbs. N/Acre

- N Applied At Seeding - \frac{20}{107.5}  Lbs. N topdressed in spring

2 pts. b) (0.63 Lbs. P₂O₅/Bu) (100 Bu/Acre) = 63 Lbs. P₂O₅ / Acre

2 pts.  c) [(0.37 Lbs. K₂O / Bu) ( 100 Bu/Acre)] + 20 = 57 Lbs. K₂O / Acre

2 pts. 8. As dormancy is broken, while tillering (prior to jointing)

4 pts. Why? (2 pts. for each of two reasons)

a) N available when needed for growth as it begins in the Spring.

b) Least foliar burn potential as exposure is limited to the first leaves.

c) Avoids stem breakage as only leaf tissue is exposed.

d) Maximum ability to compensate for damage done by wheel traffic or through leaf burn as tillering and leaf development continue until jointing.
3 pts.  9. \((70 \text{ Bu/Acre}) (0.80 \text{ Lbs. } P_2O_5/\text{Bu}) = 56 \text{ Lbs. } P_2O_5/\text{Acre}\)

3 pts.  \([(70 \text{ Bu/Acre}) (1.40 \text{ Lbs. } K_2O/\text{Bu})] + 20 = 118 \text{ Lbs. } K_2O/\text{Acre}\)

3 pts.  10. a) **Group II soybeans will flower sooner** as they will flower in response to a slightly longer photoperiod than will the group III variety as daylight hours per 24 hour day decline between June 21 and December 21.

3 pts.  b) **Group II soybeans would normally be adapted to a slightly more northern latitude** (2 pts.) than would the group III variety
(1 pt. for either of the following reasons)
as the more northern latitudes exhibit more daylight hours per 24 hour than more southern latitudes on a given Summer day. Also, the more northern adapted varieties must flower earlier (in the presence of relatively long (i.e. greater hours and minutes of daylight per 24 hours) because of the shorter season available.

3 pts.  11. a) **Indeterminate plants are generally taller than determinate plants of comparable maturity.**
Indeterminate plants continue to grow vegetatively for a time after flowering and pod initiation has begun (up to 6 weeks). In contrast, Determinate plants flower over a relatively brief period.

3 pts.  b) **Indeterminate plants have a maximum of one to three small pods at the uppermost node while Determinate plants have a terminal raceme or cluster of pods.** Indeterminate plants continue vegetative growth while flowering progresses up the main stem, hence the uppermost pods are developmentally younger and smaller. Because of the more nearly-uniform flowering pattern of Determinate soybeans, pod number and size are more nearly uniform from top to bottom on the plant.

4 pts.  12. Diameter = 29 inches; Radius = 14.5 inches.

\[
\frac{43560}{(3.14)(14.5^2)/144} = 9500.6 \text{ Hoop Areas Per Acre}
\]

\[
(19 \text{ Plants Per Hoop}) (9500.6 \text{ Hoop Areas Per Acre}) = 180511.4 \text{ Plants Per Acre}
\]

4 pts.  13. The yield advantage for narrow rows (vs. wide rows) is greater at more northern latitudes.

4 pts.  The relatively - shorter growing season length at northern latitudes means adapted varieties have fewer days for vegetative growth before flowering than adapted varieties at more southern latitudes. Plants at the northern latitudes will generally then be more compact and should be in drill rows to maximize light capture during R4-R7 (seed development) and thereby optimize yield potential.
2 pts. 14. a) R1 = A flower anywhere on the main stem.

2 pts. b) R2 = A flower at one of the two uppermost developed nodes on the main stem.

2 pts. c) R4 = A pod > or equal to 3/4 inch (2 cm) long at one of the top four fully developed main stem nodes.

2 pts. d) R5 = A seed > or equal to 1/8 inch (3mm) long in a pod at one of the top four fully developed main stem nodes.

4 pts. 15. a) 2 plants per foot of row. Approximately 174,240 plants per acre

4 pts. b) 6 plants per foot of row. Approximately 104,544 plants per acre

5 pts. BONUS

Leaf canopy closure must be accomplished by the time of reproductive growth i.e. early pod fill (potentially even by flowering) in order to optimize light use with respect to yield potential.

When plants are relatively short (usually because they have had a limited time for vegetative growth) going into this reproductive period of the season they are unable to close the leaf canopy so light is wasted in between the rows and yield potential is lost. Examples of such situations may include; a) very late planting as for double crop soybeans after wheat in northern Indiana, b) planting an early variety at a given location [a Maturity Group II variety would be probably respond more positively to drill rows than would a group III variety when both are planted in central Indiana on the same date], c) planting an adapted variety at a northern location vs. an adapted variety at a southern location [more northern location produces a stronger yield advantage for drill rows], planting a determinate variety adapted to a northern latitude [e.g. Maturity Group IV and earlier], d) soybeans grown under un-irrigated dryland conditions.