Evaluation of Soybean Varieties for Iron-deficiency Chlorosis (1982)

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Evaluation of Soybean Varieties for Iron-deficiency Chlorosis (1982)

Keywords
Keeping up with research; 59 (June 1982); Kansas Agricultural Experiment Station contribution; no. 82-338-s; Soybeans; Iron-deficiency chlorosis

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Introduction

Iron-deficiency chlorosis is a physiological disease caused by decreased iron in the soybean plant. Iron chlorosis is common when soybeans are grown on calcareous soils found in Kansas. Iron is required for formation of chlorophyll, the green pigment found in plants. When iron is limiting, iron chlorosis symptoms may be expressed in soybean plants. Interveinal chlorosis is the most common symptom, in which the leaves become yellow, with the veins remaining green. In severe cases, the leaves become white or necrotic, with stunted plant growth. Seed yield loss is a function of the severity of yellowing that occurs to the plant.

Planting soybean varieties with resistance to iron-deficiency chlorosis represents an effective method to protect against losses to the disease (Figure 1). Resistant varieties increase protection for the younger leaves and the growing point, decreasing death rates and improving chances for recovery. Screening soybean varieties for iron-deficiency chlorosis is critical. Soybean growers need updated information on the chlorosis response of soybean varieties to Kansas soil and growing conditions. To address this need, this research evaluated currently grown commercial soybean varieties for resistance to iron-deficiency chlorosis.

Procedures

Two hundred thirty five soybean varieties, with three checks [resistant checks A14 and A15; susceptible check KS4202RR] with known responses were planted on July 1, 2005, in a greenhouse at Kansas State University to observe their chlorosis response to soil with a high pH. The soybean varieties were grown in soil collected, 0 to 6 inches deep, from an agricultural field near Zeandale, Kansas. Plants expressing chlorosis have been observed growing in this field in the past. The soil type for this field was Haynie sandy loam with a soil pH of 7.8. To enhance plant growth, phosphorus, zinc, and copper solutions were added to the soil. A .5 quart container was filled with approximately one pound of this amended soil, and 5 seeds of each entry were planted approximately 1 inch below the soil surface, and thinned to 2 plants after emergence (Figure 2). After emergence, the containers were placed in large, black plastic flats for bottom watering with a sodium nitrate solution.

Iron uptake values were recorded as chlorophyll (greenness) measurements with a Minolta SPAD-502 Chlorophyll Meter. Ratings were averaged from three plots for each entry. Chlorophyll concentrations were taken when the first and second trifoliate leaves were fully expanded, 12 and 17 days after emergence, respectively. The chlorophyll concentrations were taken on the center leaflet of the fully expanded trifoliate of two plants per container.

Results

Chlorophyll concentrations differed among the 235 varieties evaluated (Table 1). A wide range of chlorophyll concentrations were observed during this experiment (Figure 3). Average chlorophyll concentration across the two growth stages was 21.0 SPAD. The chlorosis-resistant checks, A14 and A15, possessed mean chlorophyll...
scores of 27.7 and 28.7, respectively. The score of 28.7 was the highest average reading among the entries evaluated. Germplasm lines A14 and A15 were released in 1987 for parent stock in soybean breeding and genetics programs. These checks were identified after seven cycles of selection for improved resistance to iron-deficiency chlorosis on calcareous soils in the field. In previous research, the iron-chlorosis-resistant check A15 had been shown to do well in defending against iron-deficiency chlorosis in Kansas soils. Although both A14 and A15 possess superior chlorosis resistance, they are not adapted varieties for Kansas conditions.

No commercial variety possessed resistance significantly greater than these two checks. But out of the 235 varieties tested, 34 commercial varieties possessed average chlorophyll readings that were not significantly lower than the A15 resistant check. These 34 varieties are adapted to Kansas and possess a variety of agronomic characteristics sought by soybean producers.

This study has successfully identified commercial soybean varieties that possess resistance to iron-deficiency chlorosis. Producers are encouraged to use these results with information from seed companies/dealers to select varieties to help eliminate or reduce yield losses from iron-deficiency chlorosis.

### Table 1. Evaluation of soybean varieties for iron chlorosis tolerance.

| Brand          | Name       | Chlorophyll Reading (SPAD) | Brand          | Name       | Chlorophyll Reading (SPAD) |
|----------------|------------|----------------------------|----------------|------------|----------------------------|
| ISU            | A15        | 28.7                       | ADVANCED GENETICS | AG3833NRS  | 15.8                       |
| ISU            | A14        | 27.7*                      | AGSOURCE       | 9383       | 19.7                       |
| DYNA-GRO       | DG 39G43   | 28.4*                      | AGSOURCE       | 9436       | 18.8                       |
| DYNA-GRO       | DG 36M49   | 26.3*                      | ASGROW         | AG3005     | 27.0*                      |
| DYNA-GRO       | DG 33A37   | 25.7*                      | ASGROW         | AG3905     | 25.3*                      |
| DYNA-GRO       | DG 35D33   | 25.0*                      | ASGROW         | AG3906     | 23.2                       |
| DYNA-GRO       | DG 37R39   | 25.0*                      | ASGROW         | AG3602     | 22.6                       |
| DYNA-GRO       | DG 33B52   | 23.7                       | ASGROW         | AG4903     | 19.9                       |
| DYNA-GRO       | DG 32C38   | 22.0                       | ASGROW         | AG3505     | 19.4                       |
| DYNA-GRO       | DG 35P29   | 20.1                       | ASGROW         | AG5301     | 19.1                       |
| DYNA-GRO       | DG 3468NRR | 19.3                       | ASGROW         | AG4801     | 18.8                       |
| DYNA-GRO       | DG 39M53   | 18.1                       | ASGROW         | AG5501     | 18.0                       |
| DYNA-GRO       | SXO5138    | 16.1                       | ASGROW         | AG3305     | 17.6                       |
| KSU            | K1631RR    | 25.9*                      | ASGROW         | AG4703     | 17.3                       |
| KSU            | KS4202     | 24.8*                      | ASGROW         | AG3802     | 17.3                       |
| KSU            | K1630RR    | 23.2                       | ASGROW         | AG4503     | 16.4                       |
| KSU            | K4602RR    | 22.3                       | ASGROW         | AG4404     | 16.4                       |
| KSU            | KS4704RR   | 21.7                       | ASGROW         | AG5605     | 13.7                       |
| KSU            | K1623RR    | 21.3                       | ASGROW         | AG4403     | 12.7                       |
| KSU            | K5502RR    | 21.1                       | CROPLAN GENETICS | RT3555  | 26.2*                      |
| KSU            | KS5004N    | 19.6                       | CROPLAN GENETICS | RC4013  | 23.9                       |
| KSU            | K4202RR    | 18.4                       | CROPLAN GENETICS | RC3732  | 23.6                       |
| KSU            | KS4404RR   | 17.4                       | CROPLAN GENETICS | RC4095  | 22.4                       |
| KSU            | K1463RR    | 14.5                       | CROPLAN GENETICS | RC3735  | 22.1                       |
| ADVANCED GENETICS | AG3722NRR | 26.3*                      | CROPLAN GENETICS | RC4655  | 21.6                       |
| ADVANCED GENETICS | AG4040NRR | 25.6*                      | CROPLAN GENETICS | RC5455  | 21.2                       |
| ADVANCED GENETICS | AG5005NRR | 25.4*                      | CROPLAN GENETICS | RC4455  | 17.2                       |
| ADVANCED GENETICS | AG4880NRS | 24.1                       | CROPLAN GENETICS | RC3636  | 16.8                       |
| ADVANCED GENETICS | AG4559NRS | 24.0                       | DEKALB         | DKB36-52  | 23.1                       |
| ADVANCED GENETICS | AG4444NRR | 22.2                       | DEKALB         | DKB34-51  | 19.3                       |
| ADVANCED GENETICS | AG5440NRS | 20.0                       | DEKALB         | DKB44-51  | 18.8                       |
| ADVANCED GENETICS | AG5333NRR | 19.7                       | DEKALB         | DKB38-52  | 16.4                       |
| Brand        | Name                | Chlorophyll Reading (SPAD) | Brand        | Name                | Chlorophyll Reading (SPAD) |
|--------------|---------------------|----------------------------|--------------|---------------------|----------------------------|
| DEKALB       | DKB42-51            | 15.7                       | MFA MORSOY   | RT 4485N           | 20.8                       |
| DEKALB       | DKB46-51            | 13.6                       | MFA MORSOY   | RT 3804N           | 20.5                       |
| DELTAPINE    | DP3861RR            | 25.8*                      | MFA MORSOY   | RTS 4824           | 17.4                       |
| DELTAPINE    | DP4331RR            | 19.1                       | MFA MORSOY   | RT 5154N           | 16.5                       |
| DRUSSEL SEED | 3772RR              | 25.7*                      | MFA MORSOY   | RT 4731N           | 15.2                       |
| DRUSSEL SEED | 3902RR              | 20.1                       | MIDLAND      | MG9A373NRR         | 26.0*                      |
| GARST        | 2834RR              | 26.1*                      | MIDLAND      | MG9B395NRR         | 26.0*                      |
| GARST        | 4212RR/STS/N        | 25.8*                      | MIDLAND      | MG9A406NRS         | 23.9                       |
| GARST        | 3212RR/N            | 25.6*                      | MIDLAND      | MG9A485XR          | 20.5                       |
| GARST        | 2721RR/N            | 25.1*                      | MIDLAND      | MG9A385NRS         | 22.8                       |
| GARST        | 3624RR/N            | 24.5                       | MIDLAND      | MG4106NRR          | 21.3                       |
| GARST        | 4612RR/N            | 24.0                       | MIDLAND      | MG9A375XR          | 21.3                       |
| GARST        | 3512RR/N            | 22.4                       | MIDLAND      | MG9A545NRS         | 20.9                       |
| GARST        | D484RR/N            | 22.0                       | MIDLAND      | MG4806NRS          | 20.8                       |
| GARST        | 5412RR/STS/N        | 21.6                       | MIDLAND      | MG9A432NRS         | 20.8                       |
| GARST        | 3712RR/N            | 19.6                       | MIDLAND      | MG9A402NRR         | 20.0                       |
| GARST        | 4999RR/N            | 17.9                       | MIDLAND      | MG4506NRR          | 19.6                       |
| GARST        | 3812RR/N            | 17.9                       | MIDLAND      | MG3806RR           | 18.4                       |
| GARST        | 4512RR/N            | 17.8                       | MIDLAND      | MG9A462NRS         | 18.0                       |
| GARST        | 3824RR/N            | 16.0                       | MIDLAND      | MG3826NRR          | 18.0                       |
| HAMON        | AG4604N             | 18.1                       | MIDLAND      | MG3816NRS          | 17.5                       |
| KRUGER       | K-473RR/SCN         | 24.4                       | MIDLAND      | MG9A494XR          | 16.2                       |
| KRUGER       | K-328RR             | 23.8                       | MIDLAND      | MG9A355XR          | 16.1                       |
| KRUGER       | K-399RR/SCN         | 20.6                       | MIDLAND      | MG4807XR           | 15.3                       |
| KRUGER       | K-349RR             | 22.3                       | MIDLAND-PHILLIPS | 346NRR       | 26.3*                      |
| KRUGER       | K-361RR/SCN         | 22.3                       | MIDLAND-PHILLIPS | 366NRS       | 22.1                       |
| KRUGER       | K-333RR/SCN         | 21.8                       | MIDLAND-PHILLIPS | 374NRR       | 21.5                       |
| KRUGER       | K-404RR             | 21.2                       | MIDLAND-PHILLIPS | 385NRS       | 19.6                       |
| KRUGER       | K-311RR/SCN         | 21.1                       | MIDLAND-PHILLIPS | 333RS        | 19.2                       |
| KRUGER       | K-433RR/SCN         | 18.3                       | MIDLAND-PHILLIPS | 354RS        | 18.5                       |
| KRUGER       | K-373RR/SCN         | 19.4                       | MIDWEST SEED  | GR4454           | 25.1*                      |
| KRUGER       | K-355RR/SCN         | 19.4                       | MIDWEST SEED  | GR4154           | 24.5                       |
| KRUGER       | K-389RR/SCN         | 18.8                       | MIDWEST SEED  | GR5231           | 20.7                       |
| KSOY         | KS4602N             | 27.6*                      | MIDWEST SEED  | GR3633           | 19.9                       |
| KSOY         | KS5502N             | 20.3                       | MIDWEST SEED  | GRX48-01-5       | 19.2                       |
| LEWIS        | 4010                | 24.7*                      | MIDWEST SEED  | GR4752           | 16.7                       |
| LEWIS        | 3716                | 22.8                       | M-PRIDE      | AxRR53116        | 26.0*                      |
| LEWIS        | 3853                | 22.5                       | M-PRIDE      | AxRR53976        | 25.6*                      |
| LEWIS        | 3822                | 21.9                       | M-PRIDE      | AxRR53776        | 23.9                       |
| LG SEEDS     | C3031RR             | 21.0                       | M-PRIDE      | AxRR53386        | 22.2                       |
| MARYLAND     | MANOKIN             | 21.4                       | M-PRIDE      | MPV4905NRR       | 22.0                       |
| MFA MORSOY   | RT 4845N            | 25.3*                      | M-PRIDE      | AxRR53057        | 19.0                       |
| MFA MORSOY   | RT 5043N            | 24.2                       | M-PRIDE      | MPV5505NRR       | 18.7                       |
| MFA MORSOY   | RT 4225N            | 23.3                       | M-PRIDE      | MPV4404NRR       | 17.9                       |
| Brand | Name     | Chlorophyll Reading (SPAD) | Brand | Name     | Chlorophyll Reading (SPAD) |
|-------|----------|----------------------------|-------|----------|----------------------------|
| NK    | S35-F9   | 24.3                       | PIONEER | 94M80  | 16.6                       |
| NK    | S37-N4   | 23.5                       | PRAIRIE BRAND | PB-5083NRR | 26.2*                     |
| NK    | S57-P1   | 23.1                       | PRAIRIE BRAND | PB-4583NRR | 22.6                     |
| NK    | S29-C9   | 22.1                       | PRAIRIE BRAND | PB-3894NRR | 20.2                     |
| NK    | S46-W8   | 22.0                       | PRAIRIE BRAND | PB-3905RR | 20.1                     |
| NK    | S32-G5   | 21.8                       | RENZE   | R3996RRcn | 23.2                     |
| NK    | S42-P7   | 21.4                       | RENZE   | R3814RR  | 23.0                     |
| NK    | S49-Q7   | 21.0                       | RENZE   | R4836SRcn | 21.8                     |
| NK    | S39-Q4   | 20.6                       | RENZE   | R4486RRcn | 20.7                     |
| NK    | S40-R9   | 19.8                       | RENZE   | R3686RRcn | 20.7                     |
| NK    | S43-B1   | 19.7                       | RENZE   | R4695RRcn | 19.9                     |
| NK    | X428R    | 17.5                       | RENZE   | R3835SSRcn | 18.9                    |
| NK    | S52-U3   | 17.2                       | RENZE   | R3726RR  | 15.5                     |
| NK    | S39-K6   | 15.1                       | STINE   | S3942-4  | 25.5*                     |
| OHLDE | O-3522NRR| 25.0*                      | STINE   | S3932-4  | 23.0                     |
| OHLDE | O-3882NRR| 22.5                       | STINE   | S3832-4  | 22.5                     |
| OHLDE | O-3334NRR| 22.0                       | STINE   | S4532-4  | 22.3                     |
| OHLDE | O-3494   | 21.4                       | STINE   | S4102-4  | 21.5                     |
| OHLDE | O-3932NRR| 20.6                       | STINE   | S4842-4  | 21.4                     |
| OHLDE | O-4595   | 20.1                       | STINE   | S3600-4  | 20.6                     |
| OHLDE | O-3727NRS| 19.9                       | STINE   | S4302-4  | 19.4                     |
| OHLDE | O-4292   | 19.5                       | STINE   | S3532-4  | 19.2                     |
| OHLDE | O-3712NRR| 16.2                       | TAYLOR  | 427RRS   | 24.8*                    |
| PHILLIPS | 385NRS   | 23.9                       | TAYLOR  | EXP3960-5RR | 24.2                   |
| PHILLIPS | 432NRS   | 22.5                       | TAYLOR  | 353RR    | 20.7                     |
| PHILLIPS | 436NRS   | 21.5                       | TAYLOR  | 387RR    | 20.4                     |
| PHILLIPS | 366NRS   | 21.2                       | TAYLOR  | 398RRS   | 18.3                     |
| PHILLIPS | 465NRR   | 19.4                       | TAYLOR  | EXP4400-5RR | 19.6                   |
| PHILLIPS | 376NRR   | 18.2                       | VIRGINIA | HUTCHESON | 24.9*                    |
| PHILLIPS | 486NRS   | 18.1                       | WILLCROSS | RR2486N  | 25.7*                    |
| PHILLIPS | 374NRR   | 17.8                       | WILLCROSS | RR2355N  | 23.9                     |
| PIONEER | 93M80    | 23.8                       | WILLCROSS | RR2335N  | 22.7                     |
| PIONEER | 93B85    | 23.7                       | WILLCROSS | RR2385NSTS | 20.8                 |
| PIONEER | 93B36    | 23.2                       | WILLCROSS | RR2383N  | 20.7                     |
| PIONEER | 94B73    | 22.7                       | WILLCROSS | RR2386NX2 | 19.4                     |
| PIONEER | 94M30    | 21.8                       | WILLCROSS | RR2484N  | 19.0                     |
| PIONEER | 92M91    | 21.7                       | WILLCROSS | RR2386   | 18.4                     |
| PIONEER | 93M51    | 19.1                       | WILLCROSS | RR2432N  | 18.4                     |
| PIONEER | 95M50    | 19.9                       | WILLCROSS | RR2544NSTS | 17.2              |
| PIONEER | 93M92    | 19.8                       | WILLCROSS | RR2525N  | 16.7                     |
| PIONEER | 94M50    | 19.5                       | WILLCROSS | RR2446N  | 13.8                     |
| PIONEER | 93M11    | 18.3                       | Mean    |           | 21.0                     |

* entries not significantly different from A15.
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