

## FIELD PERFORMANCE OF COTTON BASED ON THE SEED PRODUCTION YEAR

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### Abstract

A perception exists that year of seed origin can influence performance of cotton seed. Seed company perceptions have been that the vigor index is a good predictor of field performance, and that quality is mostly related to conditions encountered during production, processing, and storage. The objective of this study was to evaluate some of the effects seed age has on the field performance. Four seed lots of Deltapine NuCOTN 33 B were chosen for the study: production from 1999, 1998, 1997, and a blended seed lot. These lots did not have the same vigor index, but represented a range in quality from the very highest, to those marginally acceptable for commercial release. These four seed lots were planted in replicated field trials in four states with a total of five locations (AZ, GA, two locations in MS, SC) in 2000 to evaluate the relationship of field performance and seed production year of origin. Stand counts, plant development (plant height, node count, NAWF), and yield data were collected. The four lots averaged 178, 173, 148, and 155 seed vigor index for 1999, 1998, 1997, and blended, respectively. In the first year of the study, only one planting date was chosen, and planting and emergence conditions were very favorable. In this first year of the study, there was a significant difference for final stand count among the seed lots in relation to the vigor index (1999 > 1998 > 1997 = blended). In this study, plant development through the season was equivalent for all seed lots at all locations indicating established plants in the field grew according to field conditions and not according to differences in seed vigor index. Plant stands were adequate to produce equivalent yields for all seed lots (1115, 1134, 1129, and 1129 for 1999, 1998, 1997, and blended lots, respectively).

### Introduction

With the development of transgenic cotton varieties, the value of seed has increased making seedling vigor an even more critical factor in the cotton seed industry. The Cool Germination Test ("Texas Cool Test") is the most widely used measure of seed/seedling vigor to evaluate cotton planting-seed quality (Drummond and Savoy, 1996; Kerby et al., 1989; Metzger, 1987). Data relating seedling vigor and field performance with adequate plant stand is scarce. The purpose of this study was to evaluate the field performance of seed from several production year of origins to determine whether cotton plant development and yield are affected by the use of seed produced several years prior to planting.

### Materials and Methods

Commercial lots of Deltapine NuCOTN 33B from the last three production years were identified for testing. An additional lot of seed consisted of blended seed from the 1996, 1997, and 1998 years of production was also included. Seed vigor index was tested on a selected bag from each lot by

the Delta and Pine Land Company's Quality Assurance Laboratory in Scott, MS according to the procedures outline in the Association of Official Seed Analysts 1983 Seed Vigor Testing Handbook. The results from this test and the composition of the blended lot are presented in Tables 1 & 2. The seed-vigor index is the sum of the four-day standard ("warm") germination percentage and the cool germination percentage (Metzger, 1987).

The four lots of seed were then planted in a randomized complete block trial with replications at five locations in 2000: Belzoni MS, Hartsville SC, Maricopa AZ, Scott MS, and Tifton GA. Individual plots were four rows wide and 30 to 60 feet long depending upon test location. A seeding rate representative of the area was used for all treatments at each location.

During emergence, sequential stand counts were taken in a 10-ft row segment from each of the center two rows at 2 to 3 day intervals until counts stabilized. Weekly plant measurements of plant height, vegetative nodes, fruiting nodes and nodes above white flower (NAWF) were taken from 10 plants per plot until the trial reached physiological cutout. Plots were managed for optimum yield, spindle picked and ginned to determine lint yields. Data were statistically analyzed by treating production year as the main factor in a multi-location RCB design.

### Results and Discussion

#### Emergence

Emergence results from the five locations are presented in Table 3. Plant and emergence conditions were favorable at all locations. Plant stands at Tifton, GA, and the averaged plant stand over locations for the final stand count varied according to vigor index. There was no significant interaction between date of stand count and seed production year, indicating that average rate of emergence did not differ by production year.

#### Growth & Development

After a plant stand was established, the rate at which the cotton plants developed for each production year of origin was approximately the same. This was evident from the weekly plant measurements for height (Table 4), total nodes (Table 5), vegetative nodes (Table 6), and nodes above white flower (NAWF) (Table 7). While some of the dates show minor difference in the measured variables, there again was no significant interaction between date of observation and seed production year, indicating that after the plant was established all treatments had approximately the same rate of plant development over time.

This conclusion can be visualized by regressing height (Fig. 1), total nodes (Fig. 2), and NAWF (Fig. 3) across locations as a function of days after planting. These regressions clearly demonstrate that development rates through time were equivalent for all four seed lots. Considering the diverse geographic and environmental conditions of this study, seed quality did affect plant stand, but once plants were established, they all showed similar development patterns.

#### Yield

Yield varied according to location, but not among treatments at any location (Table 8). There was a yield trend ( $p = 0.104$ ) at Belzoni. However, this appears to be random variation as the blended lot was numerically the highest yielder while the 1997 lot was numerically the lowest. These two seed lots had a similar seed vigor index. Averaged across the five locations, there were no significant trends with all four seed lots producing yields that were within 19 lb./A (1.7 %) of the same yield.

### Summary

This study attempted to identify potential associations between seed quality and field performance across a range of environments and conditions. Results support the following conclusions: Plant stand was related to vigor

index with lower values resulting in fewer plants. Seed quality did not affect the node of the first fruiting branch, plant height, number of nodes, the rate of height and node development, the rate at which plants moved towards cutout (NAWF), or yield. Results from these studies suggest that seed quality can influence plant stand, but not the performance of surviving plants. These conclusion are based on one year of data.

### References Cites

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Table 1. Selected seed lots germination results influenced by year of seed origin.

Treatment (Year of Production)	Lot Number	Standard Germ Test		Cool Germ Test		Seed Vigor Index
		Date	Germ	Date	Germ	
1997 Production	N33BH74942	4/1/00	86%	3/29/00	64%	148
1998 Production	N33BH86422	4/1/00	91%	3/29/00	83%	173
1999 Production	N33BH96702	4/1/00	92%	3/29/00	90%	178
Blended	N33BS85992	4/1/00	84%	3/29/00	77%	155

Table 2. Germination results and the production year of origin for all the seed lots which comprised the blended lot.

Lot Number	Date	Germ Test Results (%)		Component of N33BS85992 (%)	Individual Makeup of Seed Lots	
		Standard	Cool		Production Year	Component (%)
N33BS85822	7/99	87%	72%	2%	1998	100%
N33BS85592	7/99	84%	76%	6%	1996 & 98	10% & 90%
N33BS85602	7/99	85%	69%	1%	1997 & 98	10% & 90%
N33BS85612	7/99	96%	76%	1%	& 98	2%, 8%, & 90%
N33BS85622	7/99	90%	76%	45%	1997 & 98	10% & 90%
N33BS85672	7/99	89%	84%	45%	1997 & 98	10% & 90%

Table 3 Plant stand count (# plants per 10 feet) as influenced by year of seed origin, days after planting, and test location.

Location	DAP	Treatment (Year of Production)					Avg	LSD 0.05	Prob > F
		1997	1998	1999	Blend	Avg			
Belzoni, MS	11	38.3	43.4	44.0	38.4	41.0	NS	0.680	
	14	37.3	41.6	45.8	35.6	40.1	NS	0.270	
	18	39.1	43.9	49.0	40.8	43.2	NS	0.320	
Belzoni, MS	21	37.4	42.9	46.9	39.9	41.8	NS	0.360	
	26	36.4	41.8	46.1	39.8	41.0	NS	0.390	
	28	35.8	42.6	46.5	38.8	40.9	NS	0.300	
Belzoni, MS	32	37.8	40.6	50.0	38.5	41.7	NS	0.180	
Avg over Dates		37.4	42.4	46.9	38.8	41.4	2.3	<0.0001	
Interaction Trt * DAP								NS	1.000
Hartsville, SC	4	19.5	27.0	26.5	19.3	23.1	NS	0.583	
	7	26.5	34.3	36.0	24.3	30.3	NS	0.239	
	9	37.5	43.8	51.8	37.8	42.7	NS	0.156	
Hartsville, SC	12	38.3	44.8	51.3	39.8	43.5	NS	0.157	
	16	39.3	46.3	52.8	41.8	45.0	NS	0.251	
	Avg over Dates		32.2	39.2	43.7	32.6	36.9	4.3	0.001
Interaction Trt * DAP								NS	1.000
Maricopa, AZ	11	33.6	46.1	44.4	33.0	39.3	7.4	0.035	
	15	34.3	46.9	45.5	33.6	40.1	7.7	0.038	
	18	35.1	47.8	46.0	34.0	40.7	8.3	0.051	
Maricopa, AZ	20	33.5	47.0	45.9	34.1	40.1	7.8	0.035	
	22	33.5	46.3	44.9	33.8	39.6	7.5	0.036	
	29	30.9	39.9	39.4	30.5	35.2	NS	0.135	
Avg over Dates		33.5	45.6	44.3	33.2	39.2	2.5	<0.0001	
Interaction Trt * DAP								NS	1.000
Scott, MS	7	25.0	27.4	29.5	28.1	27.5	NS	0.254	
	10	26.4	27.9	30.0	30.0	28.6	NS	0.184	
	14	27.1	27.9	30.5	31.3	29.2	NS	0.246	
Scott, MS	17	26.1	27.8	30.1	30.1	28.5	NS	0.215	
	21	26.5	29.3	30.9	29.9	29.1	NS	0.337	
	28	27.5	28.9	30.1	28.6	28.8	NS	0.772	
Avg over Dates		26.4	28.2	30.2	29.7	28.6	1.1	<0.0001	
Interaction Trt * DAP								NS	0.999
Tifton, GA	9	14.7	17.0	20.4	14.9	16.7	3.0	0.047	
	12	16.2	17.7	22.2	14.0	17.5	2.5	0.003	
	14	17.6	18.9	22.3	16.7	18.9	2.6	0.035	
Tifton, GA	19	16.4	19.8	24.0	17.0	19.3	2.6	0.004	
	22	15.5	19.5	23.3	16.6	18.7	2.6	0.004	
	Avg over Dates		16.1	18.6	22.4	15.8	18.2	1.0	<0.0001
Interaction Trt * DAP								NS	0.923
Over Location for Final Count:									
Avg Stand over Loc		30.2	35.0	39.1	31.2	33.9	2.9	0.0003	
Locations								3.3	<0.0001
Trt * Loc								NS	0.847

Table 4. Plant height (in.) as influenced by year of seed origin, days after planting, and test location.

Location	DAP	Treatment (Year of Production)				LSD 0.05	Prob > F
		1997	1998	1999	Blend		
Belzoni, MS	32	6.3	7.0	7.2	6.9	NS	0.411
	39	11.9	13.4	13.1	12.8	NS	0.306
	47	14.2	15.9	15.1	14.5	NS	0.273
Belzoni, MS	53	17.3	20.0	18.8	17.1	NS	0.164
	60	14.2	15.9	15.1	14.5	NS	0.273
	67	30.7	31.0	29.2	30.8	NS	0.916
Belzoni, MS	74	34.6	36.4	33.0	34.6	NS	0.766
	81	37.3	38.5	34.6	36.2	NS	0.579
	88	38.8	39.6	36.4	38.9	NS	0.844
Average over Dates		23.8	25.2	23.6	24.1	NS	0.170
Interaction Trt * DAP						NS	1.000
Hartsville, SC	30	4.8	5.4	5.6	4.9	NS	0.069
	37	7.3	7.9	8.3	7.1	NS	0.079
	43	12.3	11.8	11.6	11.2	NS	0.828
Hartsville, SC	51	17.4	17.2	16.4	16.7	NS	0.762
	58	23.7	24.3	23.6	23.5	NS	0.945
	66	24.7	24.4	23.0	23.1	NS	0.684
Hartsville, SC	73	29.4	29.8	27.7	30.7	NS	0.339
	80	32.3	32.9	33.8	33.2	NS	0.661
	86	33.5	33.5	33.8	33.9	NS	0.984
Hartsville, SC	92	36.2	36.1	34.7	35.2	NS	0.675
Average over Dates		22.2	22.3	21.9	22.0	NS	0.593
Interaction Trt * DAP						NS	0.951
Maricopa, AZ	32	5.2	6.1	5.2	4.6	NS	0.147
	39	8.4	9.0	7.6	7.8	0.7	0.036
	49	14.7	16.0	15.5	13.8	1.0	0.032
Maricopa, AZ	56	21.6	23.0	21.5	21.0	NS	0.176
	67	31.1	32.4	31.8	29.3	NS	0.192
	74	38.3	40.6	40.1	39.0	NS	0.070
Maricopa, AZ	82	45.4	47.9	47.5	44.4	1.6	0.021
	92	48.3	50.5	50.4	49.1	0.9	0.010
	102	56.4	53.1	52.8	47.4	NS	0.107
Average over Dates		29.9	31.0	30.3	28.5	0.5	<0.0001
Interaction Trt * DAP						NS	0.881
Scott, MS	21	2.3	2.4	2.0	1.9	NS	0.527
	28	3.9	4.0	3.7	3.7	NS	0.750
	35	7.4	7.1	7.4	7.1	NS	0.698
Scott, MS	42	13.3	12.5	12.6	11.9	0.6	0.035
	51	18.8	18.5	19.5	17.9	NS	0.114
	57	22.5	22.1	22.6	22.2	NS	0.948
Scott, MS	63	28.4	27.2	29.6	26.5	1.0	0.006
	70	31.2	31.6	32.4	30.8	NS	0.413
	77	35.3	36.8	37.0	35.5	NS	0.310
Scott, MS	85	40.6	40.9	42.7	39.9	NS	0.197
	91	40.8	41.2	44.7	41.4	2.0	0.049
Average over Dates		22.2	22.2	23.1	21.7	0.5	0.001
Interaction Trt * DAP						NS	0.763
Tifton, GA	77	35.6	36.6	35.7	35.0	NS	0.394

Table 5. Progression of plant nodes (#) as influenced by year of seed origin, days after planting, and test location.

Location	DAP	Treatment (Year of Production)				LSD 0.05	Prob > F
		1997	1998	1999	Blend		
Belzoni, MS	32	7.7	8.1	8.3	8.2	NS	0.451
	39	9.5	10.1	9.9	9.9	NS	0.115
	47	11.1	11.1	10.8	11.0	NS	0.712
Belzoni, MS	53	11.3	11.6	10.9	11.0	NS	0.226
	60	14.8	15.2	14.6	14.8	NS	0.663
	67	16.4	16.4	16.5	16.7	NS	0.964
Belzoni, MS	74	16.9	17.7	16.4	17.6	NS	0.228
	81	20.0	20.2	19.4	19.2	NS	0.522
	88	20.4	20.6	20.2	21.0	NS	0.718
Average over Dates		14.2	14.6	14.1	14.4	NS	0.135
Interaction Trt * DAP						NS	0.961
Hartsville, SC	30	5.1	5.6	5.3	4.8	0.4	0.044
	37	6.8	7.1	7.3	6.6	NS	0.149
	43	9.7	9.6	9.5	9.8	NS	0.903
Hartsville, SC	51	12.1	12.0	11.8	12.0	NS	0.391
	58	14.2	14.1	13.9	14.1	NS	0.920
	66	14.1	14.4	14.0	14.2	NS	0.832
Hartsville, SC	73	16.4	16.6	16.1	16.9	0.4	0.043
	80	17.9	18.2	17.8	18.2	NS	0.431
	86	19.1	18.8	18.8	18.2	NS	0.395
Hartsville, SC	92	19.3	19.3	19.0	19.6	NS	0.547
Average over Dates		13.5	13.6	13.4	13.4	NS	0.293
Interaction Trt * DAP						NS	0.575
Maricopa, AZ	32	6.8	7.2	6.5	6.1	NS	0.051
	39	9.4	9.2	8.5	9.1	0.4	0.040
	49	12.9	13.0	13.0	13.1	NS	0.946
Maricopa, AZ	56	15.3	15.3	15.1	15.3	NS	0.840
	67	18.2	18.3	17.7	18.1	NS	0.719
	74	21.8	22.1	22.1	22.4	NS	0.365
Maricopa, AZ	82	24.6	24.7	24.6	24.5	NS	0.983
	92	24.9	24.7	24.6	24.7	NS	0.963
	102	25.0	25.9	26.0	25.5	NS	0.790
Average over Dates		17.7	17.8	17.6	17.6	NS	0.530
Interaction Trt * DAP						NS	0.965
Scott, MS	21	3.1	3.1	3.2	2.9	NS	0.752
	28	4.0	4.7	4.2	4.2	NS	0.535
	35	8.2	8.1	8.1	8.1	NS	0.929
Scott, MS	42	10.6	10.5	10.2	10.1	NS	0.138
	51	12.9	12.3	12.4	12.4	NS	0.084
	57	13.9	13.9	13.6	14.2	NS	0.817
Scott, MS	63	16.0	15.2	15.4	15.0	NS	0.057
	70	16.9	17.6	17.4	17.1	NS	0.524
	77	18.8	18.5	18.5	18.0	NS	0.572
Scott, MS	85	20.8	20.3	20.9	20.5	NS	0.378
	91	20.1	20.3	21.2	20.6	NS	0.128
Average over Dates		13.2	13.1	13.2	13.0	NS	0.479
Interaction Trt * DAP						NS	0.726
Tifton, GA	29	6.1	6.0	5.9	5.9	NS	0.300
	33	7.0	7.2	7.1	6.9	NS	0.478
	41	9.3	9.5	9.3	9.4	NS	0.949

Table 5. Continued.

Location	DAP	Treatment (Year of Production)				LSD	Prob
		1997	1998	1999	Blend	0.05	> F
Tifton, GA	47	12.0	11.6	11.7	11.5	NS	0.570
	57	14.7	14.7	14.5	14.5	NS	0.483
	64	16.1	15.9	15.4	15.9	0.3	0.049
Tifton, GA	70	16.4	16.1	16.1	16.0	NS	0.741
	77	17.4	17.6	17.5	17.5	NS	0.930
Average over Dates		12.4	12.3	12.2	12.2	NS	0.169
Interaction Trt * DAP						NS	0.968

Table 6. Plant vegetative nodes (#) as influenced by year of seed origin, days after planting, and test location.

Location	DAP	Treatment (Year of Production)				LSD	Prob
		1997	1998	1999	Blend	0.05	> F
Belzoni, MS	47	4.7	4.5	4.3	4.3	NS	0.063
	53	4.5	4.5	4.4	4.2	NS	0.270
	60	5.4	5.5	5.4	5.4	NS	0.063
Belzoni, MS	67	5.6	5.3	5.5	5.2	NS	0.688
	74	5.0	5.0	4.6	4.8	NS	0.210
	81	5.4	5.9	5.7	5.2	NS	0.225
Belzoni, MS	88	6.0	5.8	5.2	5.6	NS	0.136
	Average over Dates		5.2	5.2	5.0	5.0	NS
Interaction Trt * DAP						NS	0.857
Hartsville, SC	43	4.5	4.5	4.5	4.4	NS	0.738
	51	4.7	4.7	4.7	4.6	NS	0.927
	58	4.8	4.8	4.8	4.8	NS	0.995
Hartsville, SC	66	5.0	5.1	5.0	5.1	NS	0.403
	73	5.1	5.0	5.1	5.2	NS	0.422
	80	5.2	5.2	5.2	5.3	NS	0.773
Hartsville, SC	86	5.3	5.2	5.3	5.1	NS	0.260
	92	4.9	5.0	4.9	5.1	NS	0.542
Average over Dates		5.1	5.1	5.0	5.1	NS	0.693
Interaction Trt * DAP						NS	0.709
Maricopa, AZ	49	4.7	5.1	4.9	4.7	NS	0.744
	56	5.0	5.3	5.3	5.5	NS	0.307
	67	5.5	5.4	5.6	5.8	NS	0.320
Maricopa, AZ	74	6.3	6.2	6.1	6.2	NS	0.830
	82	6.7	7.0	6.9	7.1	NS	0.358
	92	5.8	5.3	5.8	6.2	0.3	0.007
Maricopa, AZ	102	5.8	6.6	6.1	5.4	NS	0.122
	Average over Dates		4.9	4.9	4.9	5.0	NS
Interaction Trt * DAP						NS	0.975
Scott, MS	35	5.5	5.5	5.5	5.5	NS	0.991
	42	4.2	4.3	4.3	4.1	NS	0.105
	51	4.7	4.5	4.6	4.6	NS	0.706
Scott, MS	57	5.1	5.6	5.0	5.3	NS	0.330
	63	4.3	4.2	4.4	4.3	NS	0.228
	70	5.1	5.3	5.2	5.5	NS	0.433
Scott, MS	77	5.0	5.1	5.0	4.9	NS	0.542
	85	5.6	5.2	5.8	5.3	NS	0.509
	91	5.8	5.6	5.9	5.7	NS	0.708
Average over Dates		5.0	5.0	5.1	5.0	NS	0.944
Interaction Trt * DAP						NS	0.580

Table 7. Nodes above white flower (NAWF) as influenced by year of seed origin, days after planting, and test location.

Location	DAP	Treatment (Year of Production)				LSD	Prob
		1997	1998	1999	Blend	0.05	> F
Belzoni, MS	60	7.7	7.7	7.3	7.9	NS	0.742
	67	6.3	6.5	5.6	7.0	NS	0.176
	74	5.8	5.6	5.3	5.7	NS	0.789
Belzoni, MS	81	5.1	5.2	4.8	4.7	NS	0.612
	88	4.5	4.2	4.1	4.3	NS	0.803
Average over Dates		5.8	5.8	5.4	5.9	NS	0.148
Interaction Trt * DAP						NS	0.942
Hartsville, SC	58	7.8	7.6	7.4	7.7	NS	0.810
	66	5.8	5.9	5.5	5.7	NS	0.836
	73	5.1	5.4	4.9	5.4	0.3	0.020
Hartsville, SC	80	4.1	4.3	4.5	4.5	0.2	0.043
	86	4.2	4.0	4.1	4.0	NS	0.661
	92	3.8	3.6	3.6	3.4	NS	0.340
	Average over Dates		5.1	5.1	5.0	5.1	NS
Interaction Trt * DAP						NS	0.709
Maricopa, AZ	67	7.4	7.6	7.6	7.5	NS	0.901
	74	7.1	7.1	6.9	7.4	NS	0.478
	82	7.2	7.3	7.3	7.4	NS	0.844
Maricopa, AZ	92	5.3	5.1	5.0	5.4	NS	0.136
	102	2.9	3.3	2.9	3.3	NS	0.609
Average over Dates		6.0	6.1	5.9	6.2	NS	0.484
Interaction Trt * DAP						NS	0.995
Scott, MS	63	6.7	6.3	6.7	6.4	NS	0.484
	70	5.8	5.8	5.9	5.7	NS	0.924
	77	5.9	6.0	6.0	5.7	NS	0.503
Scott, MS	85	4.9	4.8	5.2	5.1	NS	0.051
	91	4.2	4.4	4.6	4.7	NS	0.124
Average over Dates		5.5	5.5	5.7	5.5	NS	0.476
Interaction Trt * DAP						NS	0.907
Tifton, GA	57	9.1	9.0	9.1	9.1	NS	3.917
	64	8.2	8.0	8.0	8.0	NS	0.455
	70	5.8	5.7	6.0	5.8	NS	0.453
Tifton, GA	77	4.9	4.8	4.9	4.9	NS	0.886
	Average over Dates		7.0	6.9	7.0	7.0	NS
Interaction Trt * DAP						NS	0.981

Table 8. Lint yield of cotton grown as influenced by seed year of origin, and testing locations.

Treatment (Year of Production)	Location Yield (lbs/ac)					
	Belzoni	Hartsville	Maricopa	Scott	Tifton	Avg.
1997	817	1004	1529	973	1321	1129
1998	870	1023	1517	975	1287	1134
1999	915	987	1367	945	1360	1115
Blended	916	1031	1528	941	1228	1129
Location Mean	879	1012	1485	958	1299	1127
Whole Model:						
R <sup>2</sup>	0.857	0.131	0.555	0.165	0.485	0.930
Root Mean	56.649	78.695	110.853	56.597	117.386	87.947
Square Error						
Mean Square Error	3209.1	6192.9	12288.4	3203.2	13779.6	7735.0
%C.V.	6%	8%	7%	6%	9%	8%
By Treatment:						
P	0.104	0.860	0.181	0.760	0.475	0.909
Avg. Std. Error	28.324	39.347	55.427	28.298	58.693	19.665
LSD 0.05	NS	NS	NS	NS	NS	NS
By Location:						
P			<0.0001			
Avg. Std. Error			21.987			
LSD 0.05			44.3			
By Location *						
Production Year:						
P			0.145			
Avg. Std. Error			43.973			
LSD 0.05			NS			

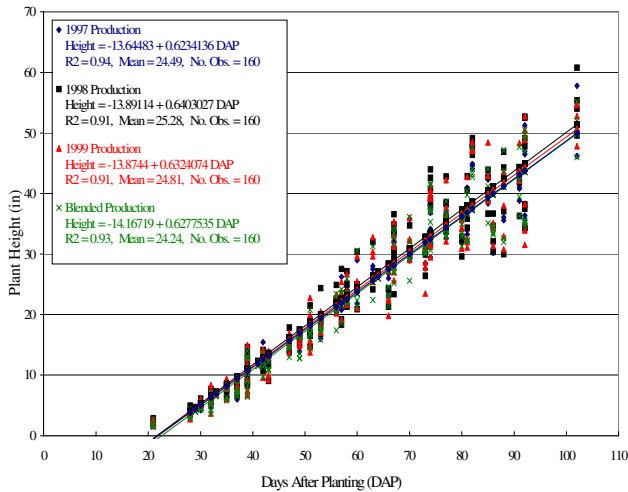


Figure 1. Plant height vs. Days after planting over locations as influenced by seed year of origin.

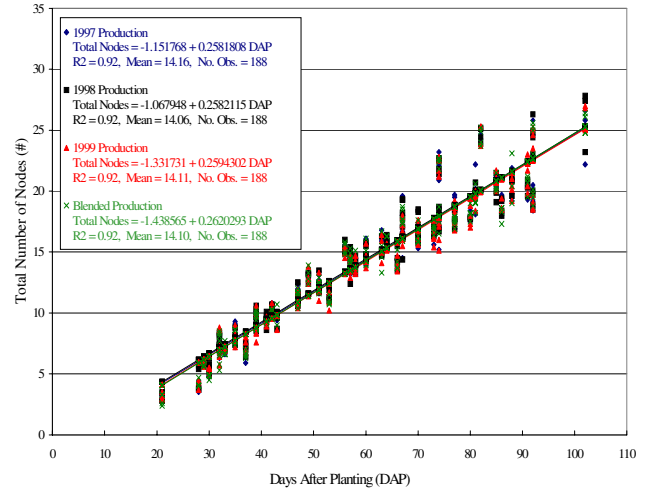


Figure 2. Total number of plant nodes vs. Days after planting across location as influenced by seed year of origin.

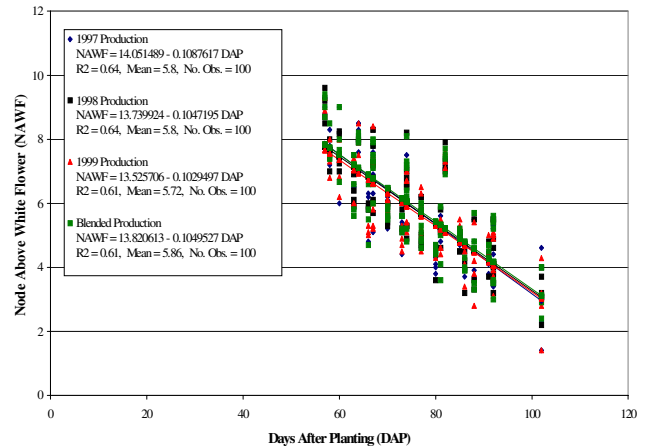


Figure 3. Nodes above white flower vs. Days after planting across locations as influenced by seed year of origin.