EFFECTS OF VARIOUS DORMANCY REDUCING TREATMENTS ON SEED GERMINATION AND ESTABLISHMENT OF INDIANGRASS *SORGHASTRUM NUTANS* (L.) NASH

by

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INTRODUCTION

Indiangrass, Sorghastrum nutans (L.) Nash, is a native pereneial, warm-season grass with short scaly rhizomes and a plume-like panicle consisting of many short racemes. Indiangrass is an important forage species in the prairie of North America and is found growing throughout the eastern and central United States and in parts of Canada and Mexico. It is nutritious and is readily eaten by livestock, either as green forage or as prairie hay.

Field establishment of indiangrass is often unsatisfactory. Many factors may be involved in poor establishment but, in indiangrass, seed dormancy appears to play a significant role (Rafii 1967).

Since a number of pregermination treatments have been shown to reduce dormancy under laboratory conditions, it is not unreasonable to suspect that such treatments could improve establishment in the field. The primary objective of this study was to determine whether certain seed treatments, that increase germination in the laboratory, can be used effectively to improve establishment in the field. It was hoped that the study also might provide useful information regarding the relationships between field establishment and such seed traits as germination, seed set, and caryopsis weight.

LITERATURE REVIEW

Mechanism of Seed Dormancy in Grasses

Delouche and Base (1954) noted that dormancy in grass seeds is usually not manifested by complete inability to germinate, but rather by an increased specificity of the environmental conditions necessary for germination. Lande (1949) reported that the seed coat of california oatgrass, Danthonia californica, appears to cause seed dormancy through mechanical restraint or through prevention of gas exchange. Therefore, weakening of the seed coat appears essential in overcoming the seed dormancy of this species. Toole (1939) found that restriction of gas exchange by the seed coat was the primary cause of low seed germination in poverty grass, Danthonia spicata. Clark et al (1967) proposed that seed dormancy in three varieties of sorghum, Sorghum bicolor (L.) Moench, was associated with initial seed moisture and functioned until seed moisture was reduced. Sun (1968) proposed that hull removal of indiangrass seed improved germination by increasing gas exchange, and that prechilling of moistened seed reduced dormancy by reduing the need for gas exchange. He found that highly dormant and less dormant caryopses of indiangrass did not differ in water uptake, and concluded that it was unlikely that water permeability of either the pericarp or the testa was involved in seed dormancy of this species.

Seed Germination and Field Establishment in Grasses

Chippindale (1949) stated that seeds of different species of grasses possess varying inherent abilities to germinate and to establish under field conditions. Tossel (1953) reported good agreement between greenhouse and field trials of smooth bromegrass, *Bromus inermis* Leyss, and concluded that tests of seed quality, in relation to early establishment, could be conducted in the greenhouse. Barnett and Vanderlip (1969) found that spikelet germination was more consistently correlated with field establishment than any other trait in indiangrass. Coukos (1944) reported that poor stands of native grass were obtained in nursery plots and field trials even when seed of high caryopsis content was sown. He suggested that prolonged seed dormancy is an important factor in establishment of these species. Rafii (1967) showed that relative establishment of strains and varieties of indiangrass may be determined by the level of seed dormancy as well as by seed viability and seedling vigor.

Dormancy-breaking Methods for Grass Seeds

Robbins and Porter (1946) overcame seed dormancy of sorghum by prechilling at 5°C. Goodsell (1957) was able to overcome sorghum seed dormancy either by scarifying the seed with a small file or by soaking the seed for a short period in hot water. Tester and McCormick (1954) found that prechilling of seed of johnsongrass, Sorghum halepense, gave an increase in germination. Lande (1949) hastened germination of seed of oatgrass, Arrhenatherum elatius, by sulfuric acid treatment and by cutting the seed coat. Niffeneger and Thies (1960) increased seed germination of canarygrass, Phalaris canariensis L. by removing the hull. Sikder (1967) found that dormancy of "paddy" seeds could be reduced by: removal of the kernels from the glumes, puncturing the glumes, or by soaking the seeds in 0.1N sulfuric acid solution for 4 hours. Ahring, Dunn and Harlan (1963) found that prechilling for 14 days at 5 to 10°C, on a substrate moistened with water or $Ca(NO_3)_2$ solution, effectively overcame seed dormancy of sand lovegrass, Eragrostis trichodes (Nutt.) Wood. Dawson and Heinrichs (1952) studied the effects of various dormancy-breaking treatments on seeds of green stipagrass, Stipa viridula, and found that seed coat removal was more effective than prechilling. Seed coat removal combined with prechilling raised germination to the level of seed viability indicated by the triphenyl tetrazolium bromide viability test.

Among pregermination treatments that have been used under laboratory conditions to reduce seed dormancy in indiangrass, prechilling and hull removal appear particularly effective (Barnett and Vanderlip, 1969; Rafii, 1967). Other treatments including soaking in water, soaking in chorox, soaking in hydrogen peroxide, and exposure to high temperature have generally yielded unsatisfactory results (Sun,1968).

MATERIALS AND METHODS

Seed Sources

Seed for this study was obtained, through open pollination, from a strain evaluation nursery established in 1963 on the Agronomy Farm of the Kansas Agricultrual Experiment Station, Manhattan, Kansas. The nursery consisted of 11 entries, in a five-replicate, randomized complete block planting. Three of the entries, 'Cheyenne,' 'Holt' and 'Osage', were used as seed sources in this study. The origins of these varieties were as follows,

Cheyenne

Developed from materials collected from native rangelands near Supply, Oklahoma by Soil Conservation Service personnel.

Holt

Developed from materials collected from Elkhorn Valley of Holt County in northeastern Nebraska.

Osage

Developed by the Kansas Agricultural Experiment Station. Osage is a synthetic of 8 clones which originated as seed in part of Kansas and Oklahoma. Seed used in this study was harvested from the first synthetic generation of Osage.

Harvest and Storage of Seed

Seed was harvested by hand stripping the spikelets from the panicles of each plot of the foregoing varieties. Seed harvested from each plot was put in a paper bag, dried at approximately 40°C for one week, and stored at room temperature under dry conditions.

Seed Treatment

Lots of 100 spikelets from each variety in each block of the seed production nursery were subjected to the following treatments.

Check

Spikelets were maintained at room temperature in a dry condition (no treatment).

Prechilling

Spikelets were placed on two layers of moistened filter paper in petri dishes and put in a refrigerator at approximately 4°C for two weeks.

Hull Removal

Hulls were removed from the spikelets through use of a rubbing board.

Prechilling Followed by Hull Removal

Spikelets were dried following prechilling and then subjected to the hull removal treatment.

Hull Removal Followed by Prechilling

Following hull removal free caryopses were placed on two layers of moistened filter paper in petri dishes and put in a refrigerator at approximately 4°C for two weeks.

Laboratory Determinations

All data were taken on samples representing each seed treatment and each variety of each block of the seed production nursery.

Spikelet Germination

Samples of 100 spikelets were placed on two layers of moistened filter paper in petri dishes and maintained in a germinator at approximately 25°C. Germination counts were made every three to five days until germination in all samples seemed at an end. Spikelets and caryopses were considered to have germinated normally when both plumule and radicle had reached a length of approximately 5 mm. When either or both, the plumule and radicle of a seedling failed to attain a length of 5 mm. germination was considered abnormal.

Seed Set

Spikelets in indiangrass occur in pairs, one sessile and perfect, the other wanting. The sessile spikelet has a perfect terminal floret and a sterile floret which is usually represented by only a sterile lemma. Each (sessile) spikelet is, therefore, normally capable of producing a single caryopsis. Accordingly, percent seed set was determined as the number of caryopses in 100 spikelets. Caryopses were separated from the chaffy appendages through use of a rubbing board.

Caryopsis weight

Hulls were removed from one-gram samples of entire spikelets by means of a rubbing board, screens, and a South Dakota seed blower. Caryopsis weight was determined as the weight in milligrams of 100 randomly selected free caryopses.

Field Emergence and Establishment

Samples of 200 spikelets were sown by hand at a depth of 0.5-1.0 cm. in sandy soil at the Plant Materials Center of the Soil Conservation Service, Manhattan, Kansas on May 12, 1967.

Plots were arranged in a randomized complete block design, each plot being a single ten-foot row. Interrow spacing was 30cm.. Weeds were controlled by hoeing and by hand. Irrigation was provided as appeared necessary through use of sprinkler hoses.

Counts of seedlings were make in June, July, and August. Counted seedlings were marked by means of white plastic hair roller pins.

The total number of counted seedlings was called field emergence. Field establishment was the number of seedlings that survived through the final count.

Statistical Design and Analysis

All the tests were designed as randomized complete block experiments with five blocks. Each block contained fifteen randomized plots which were the combinations of the 3 varieties and the 5 seed treatments.

Data obtained from above laboratory and field determinations were subjected to analyses of variance. Simple regression and correlation coefficients were computed on an individual plot basis for all possible combinations of the variables: field establishment, field emergence, normal germination, abnormal germination, seed set, and caryopsis weight.

Multiple regression analyses were used to determine the relative importance of the traits: normal germination, abnormal germination, seed set, and caryopsis weight, insofar as they influenced field establishment. Multiple-correlation analyses were used to indicate the combined effects of the above traits on field establishment.

RESULTS

Laboratory Determinations

Normal Germination

Normal germination data are summarized in Table 1 and 2. Highly significant differences occurred among seed treatments and among varieties. The treatment-by-variety interaction was significant at the .05 level. In Holt, all seed treatments resulted in a significant improvement over the check, pre-chilling followed by hull removal yielded significantly higher germination than any other seed treatment.

Abnormal Germination

Abnormal germination data are summarized in Table 3 and

4. Highly significant differences occurred among seed treatments. Variety differences were significant at the .05 level. Of all seed treatments, hull removal followed by prechilling gave the highest abnormal germination. Abnormal germination following the check and prechilling treatments was zero.

Seed Set and Caryopsis Weight

Data on seed set and caryopsis weight are summarized in Table 5, 6 and 7. Variety differences in seed set were nonsignificant whereas those in caryopsis weight were highly significant.

Field Emergence and Establishment

Field emergence and establishment data are summarized in Tables 8, 9, 10, and 11. Seedling mortality following emergence was low, with the result that the two tables show very similar percentages. In both emergence and establishment highly significant differences occurred among seed treatments and varieties. In both cases the treatment-by-variety interaction was significant at the .05 level.

Except Cheyenne, mean emergence and establishment following prechilling were significantly superior to those following all other seed treatments. Emergence and establishment following all seed treatments involving hull removal were significantly lower than those following no treatment.

Table 1. Analysis of variance for normal germination.

Source	D.F.	M.S.	F
Seed treatment	4	401.41	9.15**
Varieties	2	667.21	15.22**
Blocks	4	517.05	11.79**
Seed treatment x variety	8	115.56	2.63*
Error	56	43.83	

**Significant at .01 level *Significant at .05 level

Table 2. Mean normal germination (%) of three varieties following five seed treatments.

	Seed Treatment 1/					Variety mean
	1	2	3	4	5	
Cheyenne	30.40	29.60	29.80	34.20	20.60	28.92
Holt	7.80	21.20	24.80	33.20	20.80	21.56
Osage	13.80	17.20	20.60	25.00	18.20	18.96
Treatment mean	17.33	22.66	25.06	30.80	19.86	

L.S.D. for treatment means
at .05 level = 4.84
at .01 level = 6.45

L.S.D. for variety means
at .05 level = 3.75
at .01 level = 5.00

L.S.D. for interaction means
at .05 level = 8.39

1/
1 = check
2 = prechilling
3 = hull removal
4 = prechilling + hull removal
5 = hull removal + prechilling

Table 3. Analysis of variance for abnormal germination

Source	D.F.	M.S.	F
Seed treatment	2	43.89	6.28**
Varieties	2	30.02	4.30*
Blocks	4	16.97	2.43
Seed treatment x variety	4	10.86	1.55
Error	32	6.99	

*Significant at .05 level **Significant at .01 level

Table 4. Mean abnormal germination (%) of three varieties following seed treatments involving hull removal.

	Seed treatment 1/			Variety mean
	1	2	3	
Cheyenne	4.40	6.00	9.40	6.60
Holt	3.20	3.20	6.60	4.30
Osage	3.00	4.40	4.60	4.00
Treatment mean	3.53	4.53	6.87	

L.S.D. for treatment means
at .05 level = 1.97
at .01 level = 2.65

L.S.D. for variety means
at .05 level = 1.97
at .01 level = 2.65

1/
1 = hull removal
2 = prechilling + hull removal
3 = hull removal + prechilling

Table 5. Analysis of variance for caryopsis weight

Source	D.F.	M.S.	F
Seed treatment	4	219.55	1.68
Varieties	2	3801.97	29.01**
Blocks	4	1652.09	12.61**
Seed treatment x variety	8	66.32	0.51
Error	56	131.06	

**Significant at .01 level

Table 6. Analysis of variance for seed set.

Source	D.F.	M.S.	F
Seed treatment	4	22.37	0.22
Varieties	2	296.17	2.97
Blocks	4	1236.21	12.40**
Seed treatment x variety	8	63.36	0.64
Error	56	99.71	

**Significant at .01 level

Table 7. Mean seed set and mean caryopsis weight of three varieties.

	Seed set (%)	Caryopsis weight(mg/100)
Cheyenne	60.92	158.36
Holt	57.88	144.12
Osage	51.40	133.80

L.S.D. for caryopsis weight means
at .05 level = 8.28
at .01 level = 11.01

Table 8. Analysis of variance for emergence

Source	D.F.	M.S.	F
Seed treatment	4	2922.48	73.42**
Varieties	2	416.74	10.47**
Blocks	4	209.03	5.25**
Seed treatment x variety	8	89.80	2.25*
Error	56	39.80	

*Significant at .05 level **Significant at .01 level

Table 9. Mean emergence (%) of three varieties following five seed treatments.

	Seed treatment 1/					Variety mean
	1	2	3	4	5	
Cheyenne	39.10	41.10	7.70	4.60	7.90	22.08
Holt	25.80	42.40	7.70	15.10	6.00	19.40
Osage	21.30	29.30	4.50	8.60	6.60	14.06
Treatment mean	28.73	37.60	6.63	12.77	6.83	

L.S.D. for treatment means
at .05 level = 4.61
at .01 level = 6.15
L.S.D. for variety means
at .05 level = 3.58
at .01 level = 5.12
L.S.D. for interaction means
at .05 level = 8.00

1/
1 = check
2 = prechilling
3 = hull removal
4 = prechilling + hull removal
5 = hull removal + prechilling

Table 10. Analysis of variance for field establishment.

Source	D.F.	M.S.	F
Seed treatment	4	2718.26	69.93**
Varieties	2	413.37	10.63**
Blocks	4	200.02	5.15**
Seed treatment x variety	8	91.26	2.35*
Error	56	38.87	

*Significant at .05 level **Significant at .01 level

Table 11. Mean establishment (%) of three varieties following five seed treatments

	Seed treatment 1/					Variety mean
	1	2	3	4	5	
Cheyenne	38.00	39.40	7.30	13.80	7.60	21.22
Holt	25.20	41.20	7.30	14.80	5.80	18.56
Osage	20.10	27.80	4.30	7.90	6.40	13.30
Treatment mean	27.77	36.13	6.30	12.17	6.60	

L.S.D. for treatment means
at .05 level = 4.57
at .01 level = 6.08

L.S.D. for variety means
at .05 level = 3.57
at .01 level = 4.71

L.S.D. for interaction means
at .05 level = 6.44

1/
1 = check
2 = prechilling
3 = hull removal
4 = prechilling + hull removal
5 = hull removal + prechilling

Correlations

Simple correlation coefficients are shown in Table 12. Correlation between field emergence and establishment approached unity across all treatments and within each treatment.

Multiple correlation between field establishment and the independent variables, normal germination, seed set, caryopsis weight, and abnormal germination is summarized in Table 13. Multiple correlation approached unity with the check seed treatment and was nonsignificant with all treatments involving hull removal.

Regressions

Simple regressions, with field establishment as the dependent variable, are summarized in Table 14 and Figures 1-5. Tests of homogeneity (Appendix Tables 1,2, and 3) indicated that all simple regressions, except that of field establishment on field emergence, were heterogeneous across seed treatments. With the regressions of establishment on normal germination, seed set, and caryopsis weight, a sharp decline in the slope of the regression line with all seed treatments involving hull removal is apparent in Figures 1-5 of the text and in Figures 1-10 of the appendix.

Multiple regressions, with field establishment as the dependent variable, are summarized in Table 15.

Table 12. Simple correlation among seed and seedling traits and field establishment.

Variables correlated [1/]	Coefficient					
	Over all treatments	Within treatment [2/]				
		1	2	3	4	5
a, b	0.999**	0.998**	0.997**	0.983**	0.994**	0.992**
a, c	0.127	0.761**	0.423	0.339	0.664**	0.445
a, d	-0.542**	- [3/]	-	0.261	0.123	0.284
a, e	0.268*	0.588*	0.737**	0.627*	0.483	0.502*
a, f	0.310**	0.797**	0.269	0.213	0.410	0.362
c, d	0.173	-	-	0.008	0.050	0.534*
c, e	0.470**	0.259	0.566*	0.491	0.694**	0.874**
c, f	0.553**	0.669**	0.670**	0.798**	0.581*	0.062
d, e	0.168	-	-	0.301	0.191	0.295
d, f	0.038	-	-	0.125	0.096	0.471
e, f	0.284	0.250	0.230	0.223	0.574*	0.209

1/
a = field establishment (%)
b = field emergence (%)
c = normal germination (%)
d = abnormal germination (%)
e = seed set
f = caryopsis weight (mg/100)

2/
1 = check
2 = prechilling
3 = hull removal
4 = prechilling + hull removal
5 = hull removal + prechilling

3/
Blanks indicate that coefficients were not calculated.

*Significant at .05 level
**Significant at .01 level

Table 13. Multiple correlation between field establishment and the seed traits, normal germination, seed set, caryopsis weight, and abnormal germination.

Seed treatment	R	$100R^2$
Over all treatments	0.698**	48.7
Check	0.928**	84.5
Prechilling	0.748*	56.4
Hull removal	0.636	
Prechilling ÷ hull removal	0.670	
Hull removal + prechilling	0.599	

*Significant at .05 level
**Significant at .01 level

Table 14. Simple regression with field establishment (%) as the dependent variable

Independent variable No. [1/]	Coefficient					
	Over all treatments	Within treatment [2/]				
		1	2	3	4	5
a	0.971**	0.982**	0.992**	0.940**	0.980**	1.046**
b	0.129	0.662**	0.562	0.105	0.270**	0.160
c	-2.206**	- [3/]	-	0.242	0.153	0.405
d	0.254**	0.516**	0.101	0.029	0.093	0.063
e	0.308*	0.454*	0.667**	0.156*	0.185	0.090*

*Significant at .05 level
**Significant at .01 level

1/
a = field emergence (%)
b = normal germination (%)
c = abnormal germination (%)
d = caryopsis weight (mg/100)
e = seed set (%)

2/
1 = check
2 = prechilling
3 = hull removal
4 = prechilling + hull removal
5 = hull removal + prechilling

3/
Blanks indicate that coefficients were not calculated.

Table 15. Multiple regression with field establishment (%) as the dependent variable

Independent variable No. 1/	Coefficient					
	Over all treatments	Within treatment 2/				
		1	2	3	4	5
a	-0.108	0.304*	-0.172	-0.011	0.260	-0.127
b	-2.416**	- 3/	-	0.063	0.130	0.250
c	0.372**	0.294**	0.696*	0.150	0.003	0.123
d	0.233**	0.303*	0.119	0.013	0.006	0.012

*Significant at .05 level
**Significant at .01 level

1/
a = normal germination (%)
b = abnormal germination (%)
c = seed set (%)
d = caryopsis weight (mg/100)

2/
1 = check
2 = prechilling
3 = hull removal
4 = prechilling + hull removal
5 = hull removal + prechilling

3/ Blanks indicate that coefficients were not calculated.

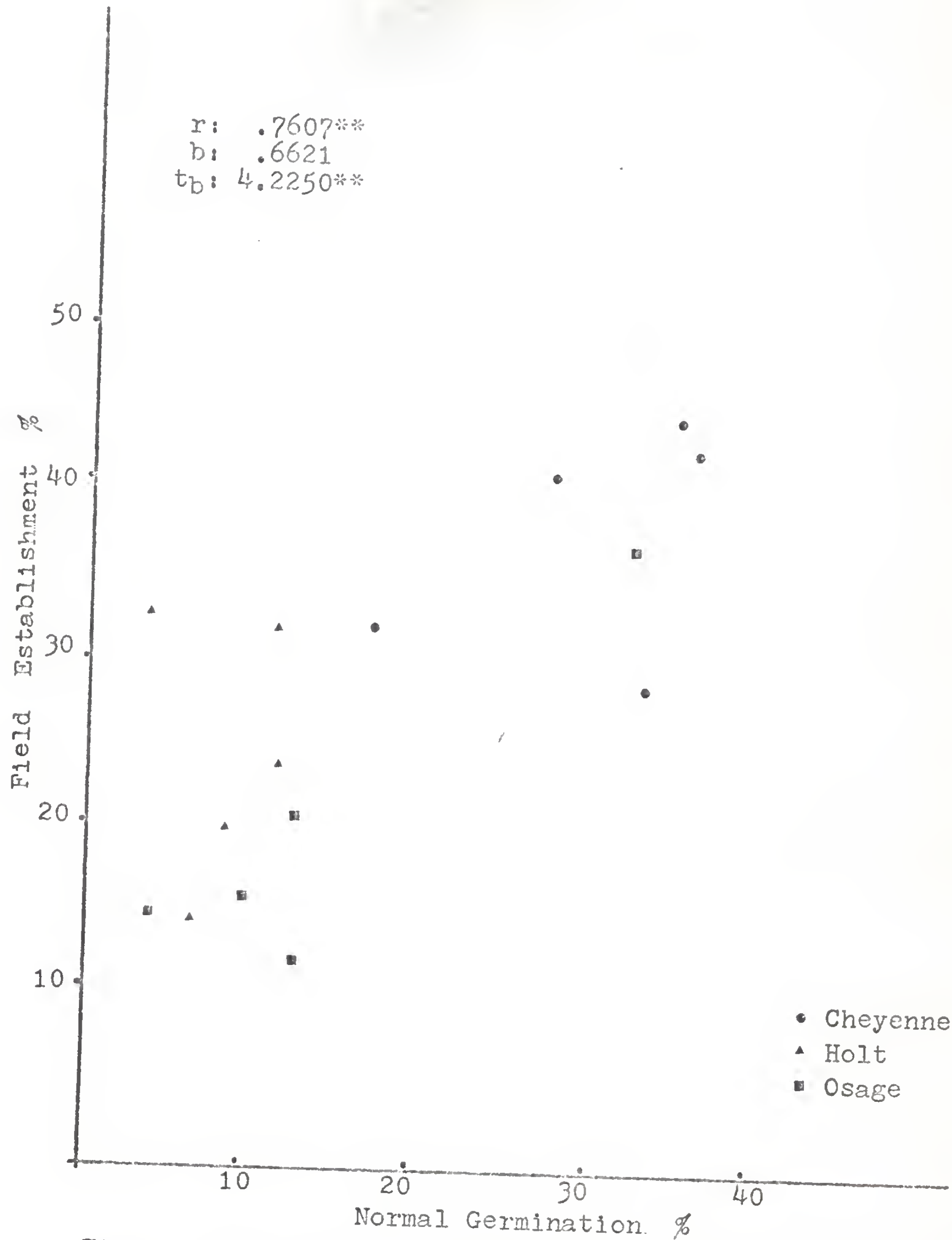

Fig.1 Relationship between normal germination and field establishment. Check treatment.

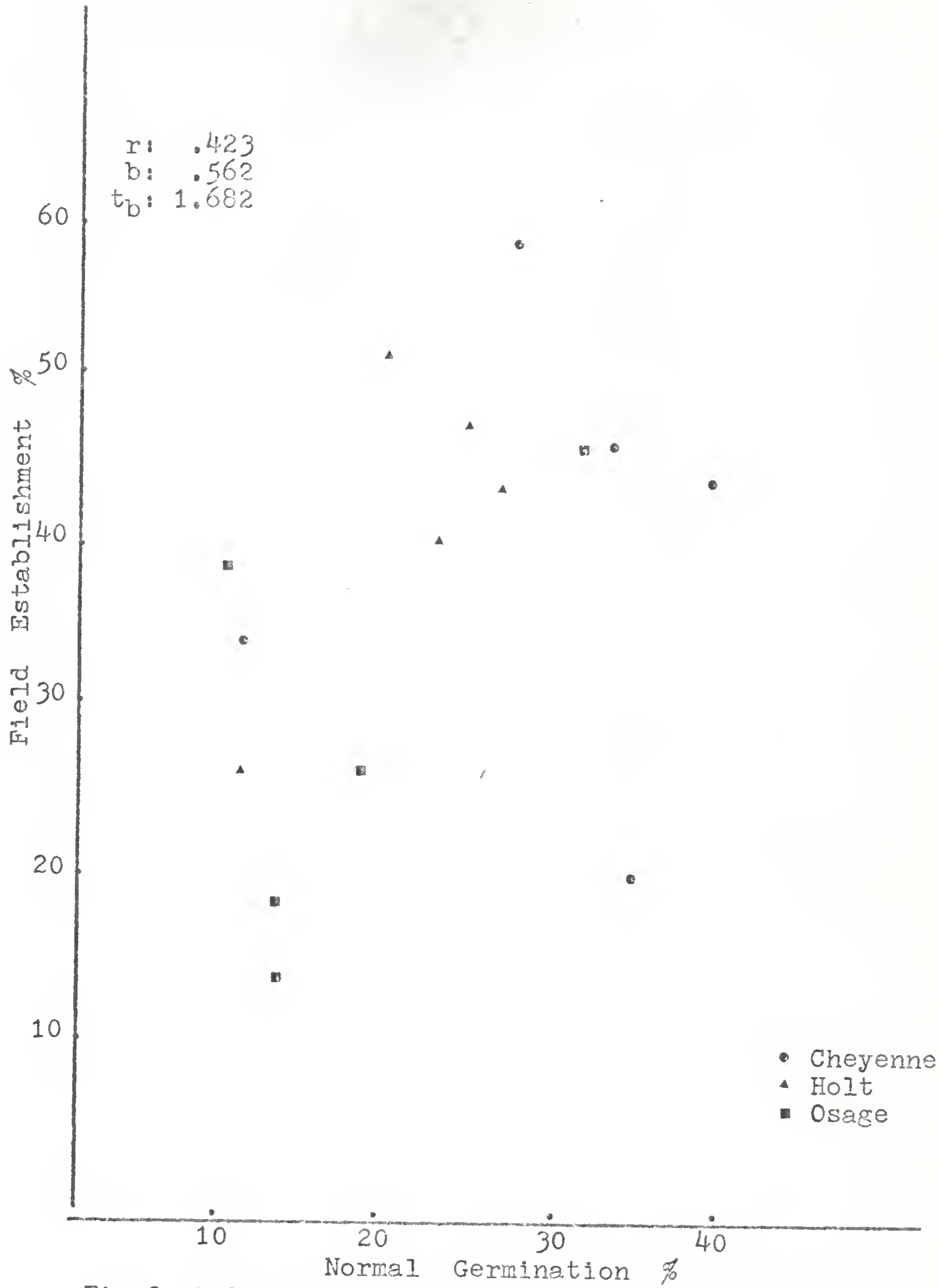

Fig.2 Relationship between normal germination and field establishment. Prechill treatment.

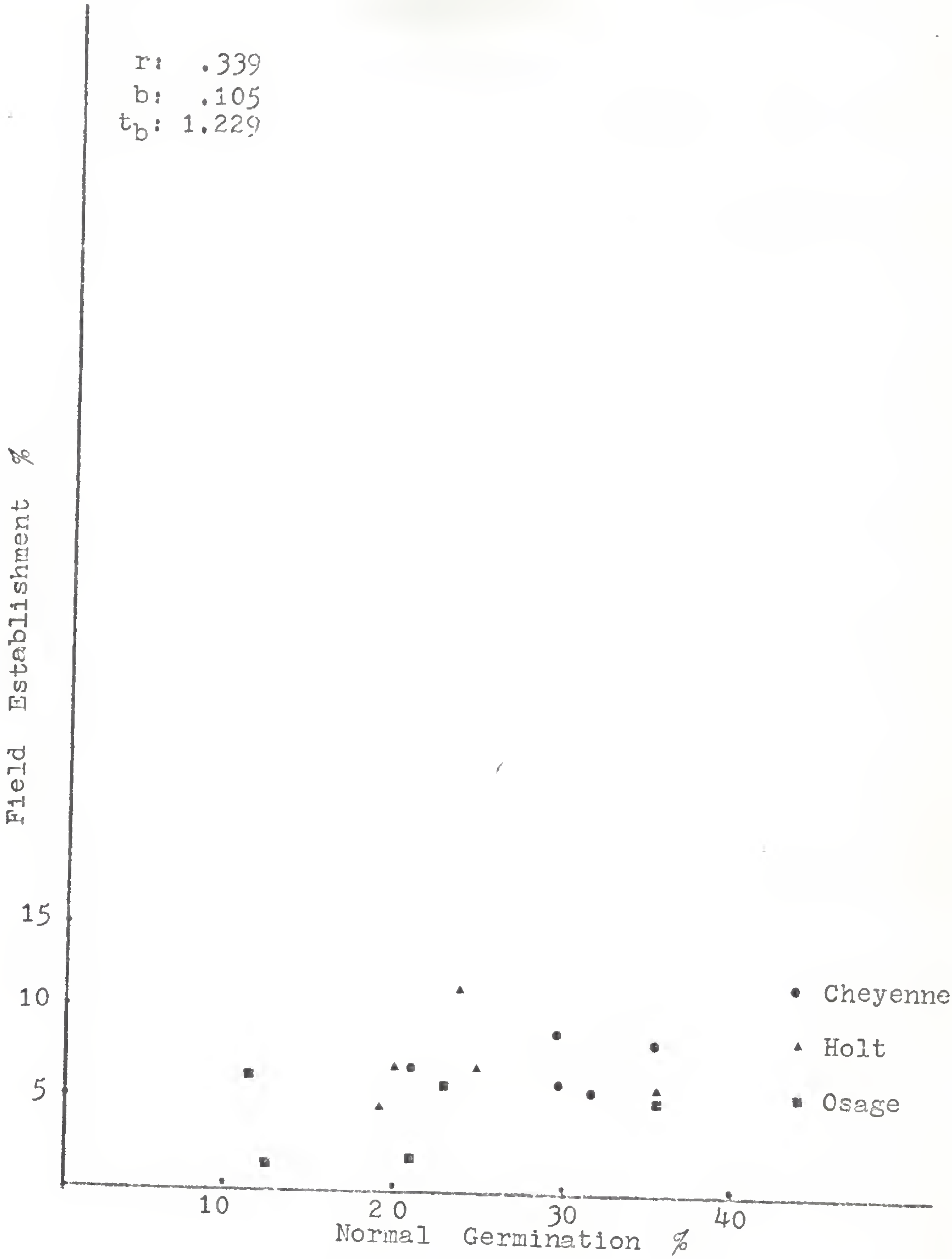

Fig. 3 Relationship between normal germination and field establishment. Hull removal treatment.

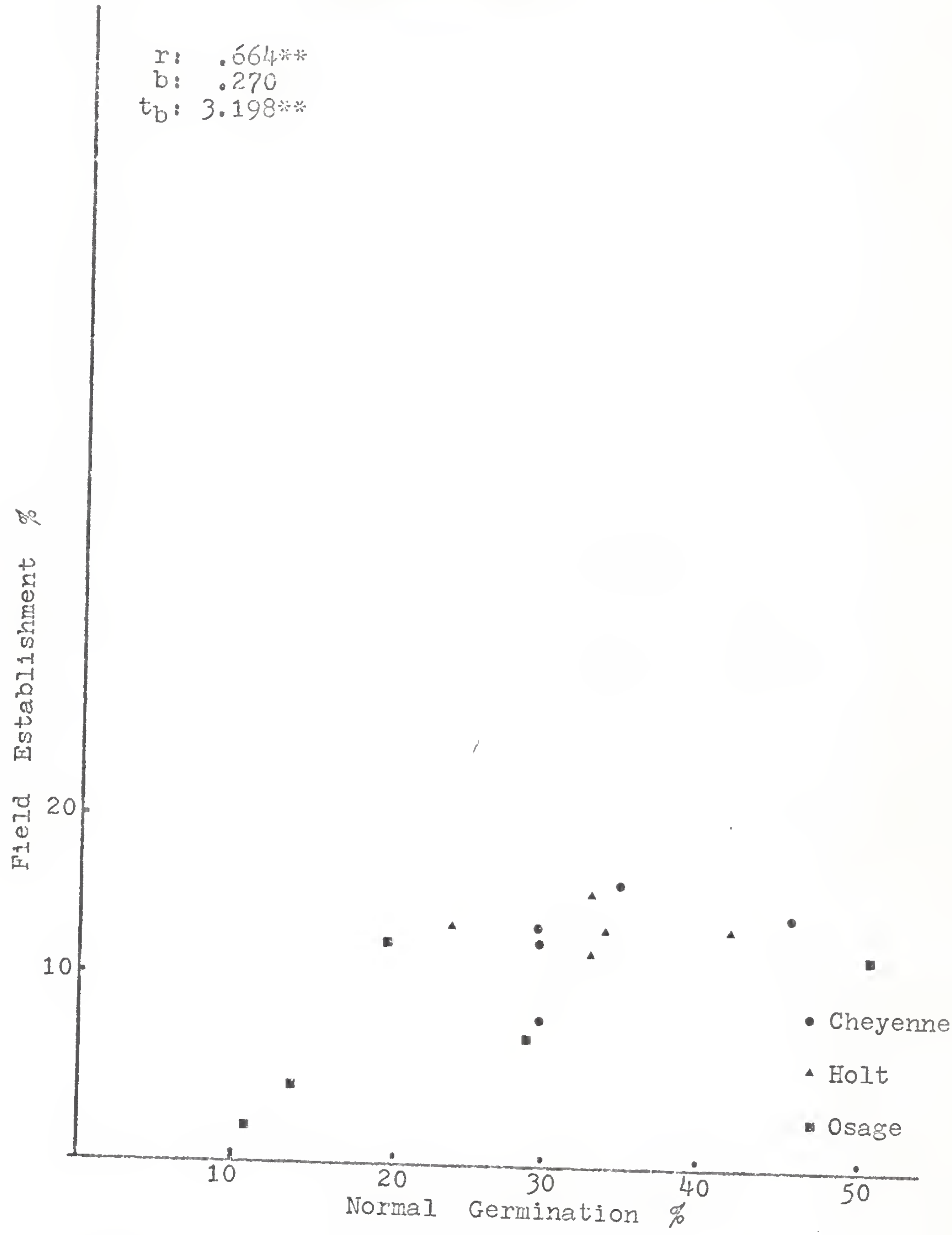

Fig.4 Relationship between normal germination and field establishment. Prechill + hull removal treatment.

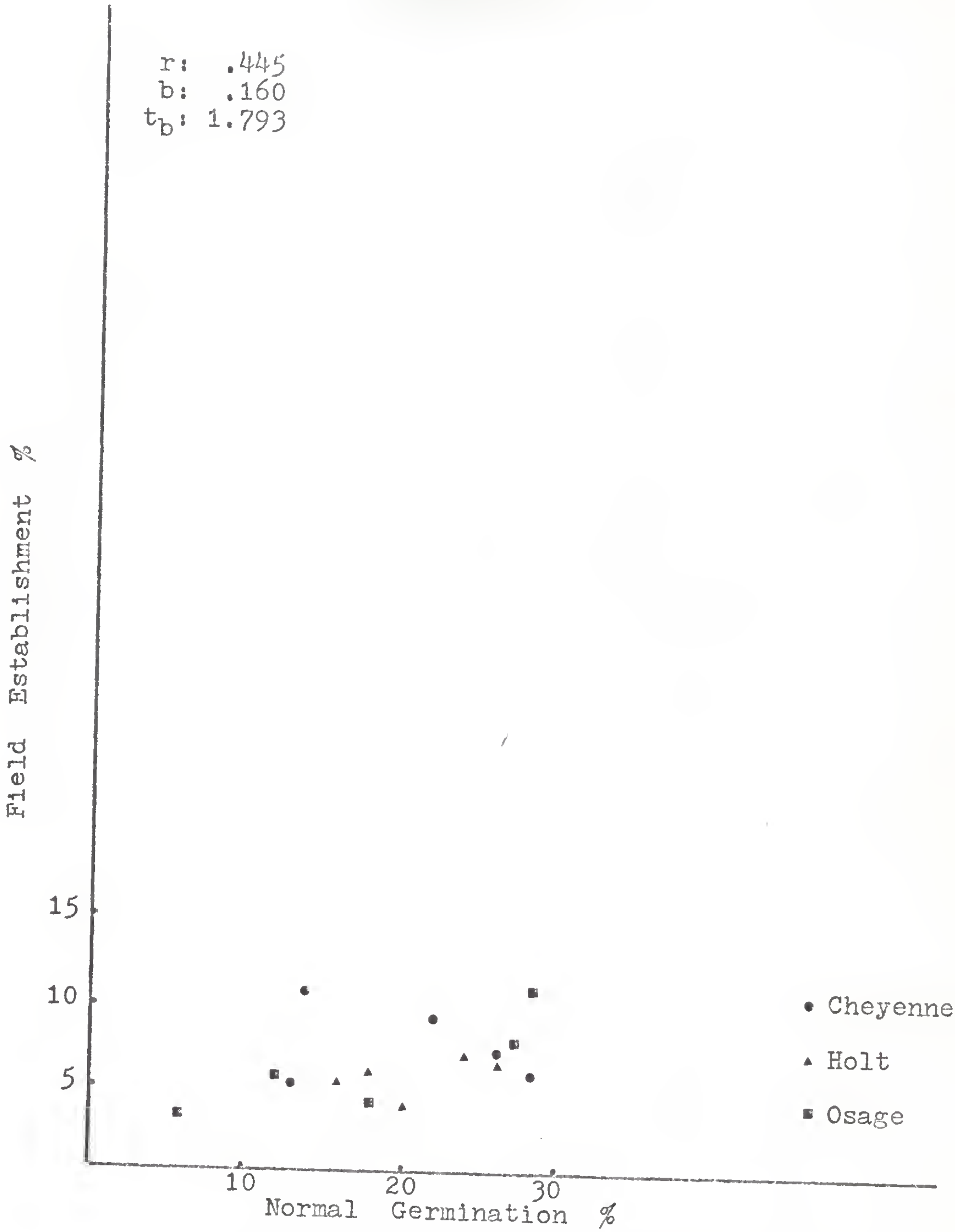

Fig.5 Relationship between normal germination and field establishment. Hull removal + prechill treatment.

DISCUSSION AND CONCLUSION

Not all seed treatments that increase germination under laboratory conditions can be relied upon to improve field establishment. Treatments involving hull removal probably reduce establishment by increasing caryopsis susceptibility to dessication and various soil organisms. Also seedling abnormality induced by hull removal may be much higher than that apparent in laboratory germination tests. Seedlings recorded as normal in laboratory tests may be sufficiently abnormal to fail to establish under field conditions.

Prechilling appears an effective method of improving field establishment from seed in which a substantial level of dormancy exists. Inasmuch as field establishment was significantly higher than laboratory germination with both check and prechilling treatments, it appears that some reduction of dormancy occurs in the field. Such factors as soil temperature, soil moisture availability, and the activity of soil microorganism may influence dormancy of seeds in the soil.

Economic feasibility of prechilling, as a practical means of improving indiangrass establishment, is questionable. It seems likely that establishment increases comparable to those demonstrated here could be obtained at lower cost through increase in seeding rate. It should be noted, however, that prechilling did not appear to remove all seed dormancy. this was particularly apparent with Holt spikelets where normal germination following prechilling was significantly less than that following prechilling plus hull removal. Comparison of seed set and germination data shows that a large number of caryopses failed to germinate following prechilling plus hull removal, the most effective dormancy-reducing treatment. Search for more effective dormancy-reducing methods seems desirable.

Sequence of seed treatments may be important. This is indicated by the fact that prechilling followed by hull removal was superior in both laboratory germination and field establishment to hull removal followed by prechilling. This may mean that hull removal predisposes caryopses to injury by prechilling, or that viability-reducing processes initiated by hull removal simply have more time to manifest themselves when the germination test is delayed by the two weeks required for prechilling.

High correlation between field emergence and establishment indicates that mortality of emerged seedlings was randomly distributed with respect to seed treatment and varieties. Differences in establishment were apparently entirely due to variation in spikelet germination and/or pre-emergence seedling mortality.

Since germination and establishment data were based on samples of initially entire spikelets, the extent to which results were influenced by seed set invites consideration. Source differences in seed set were nonsignificant at five per cent, but multiple regression indicates that establishment was significantly affected by this variable. Indeed, it appears from the regression analysis that, when dormancy was reduced through prechilling, the effect of normal spikelet germination on field establishment was largely attributable to variation in seed set.

Caryopsis weight was significantly correleted with normal germination for all the treatments except hull removal plus prechilling, but this variable significantly influenced field establishment from only untreated spikelets. Relationships among caryopsis weight, viability, and dormancy in indiangrass are not clear. Rafii (1967) found, in one multiple regression analysis, that the influence of caryopsis weight on spikelet germination increased from nonsignificance at high levels of dormancy to significance at one per cent when all dormancy was presumably broken. In another analysis, with seed of a different harvest, he found the reverse relationship.

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APPENDIX

Table 1. Homogeneity test of the deviation about regression lines among treatments. 1/

Deviations	D.F.	S.S.	M.S.
Common	69	16054.12	
Within treatments			
1	13	746.97	
2	13	1967.03	
3	13	86.77	
4	13	161.46	
5	13	59.22	
Total	65	3021.46	46.48
Among treatment	4	13032.65	162.90

$$F = \frac{162.90}{46.48} = 3.50^{**}$$

1/ Dependent variable: field establishment
Independent variable: normal germination

**Significant at .01 level

Table 2. Homegeneity test of the deviation about regression lines among treatment.[1/]

Deviation	D.F.	S.S.	M.S.
Common	69	15127.18	
Within treatments			
1	13	1107.75	
2	13	1016.10	
3	13	60.02	
4	13	216.96	
5	13	54.18	
Total	65	2455.03	37.76
Among treatment	4	12672.14	1584.00

$$F = \frac{1584.00}{37.76} = 41.94^{**}$$

1/ Dependent variable: field establishment
Independent variable: Seed Set

**Significant at .01 level

Table 3. Homegeneity test of the deviation about regression lines among treatment.1/

Deviation	D.F.	S.S.	M.S.
Common	69	14766.38	
Within treatments			
1	13	669.50	
2	13	2252.76	
3	13	91.53	
4	13	238.85	
5	13	63.65	
Total	65	3316.29	51.01
Among treatment	4	11450.09	1431.26

$$F = \frac{1431.26}{51.01} = 28.05^{**}$$

1/
Dependent variable: field establishment
Independent variable: Caryopsis weight

**Significant at .01 level

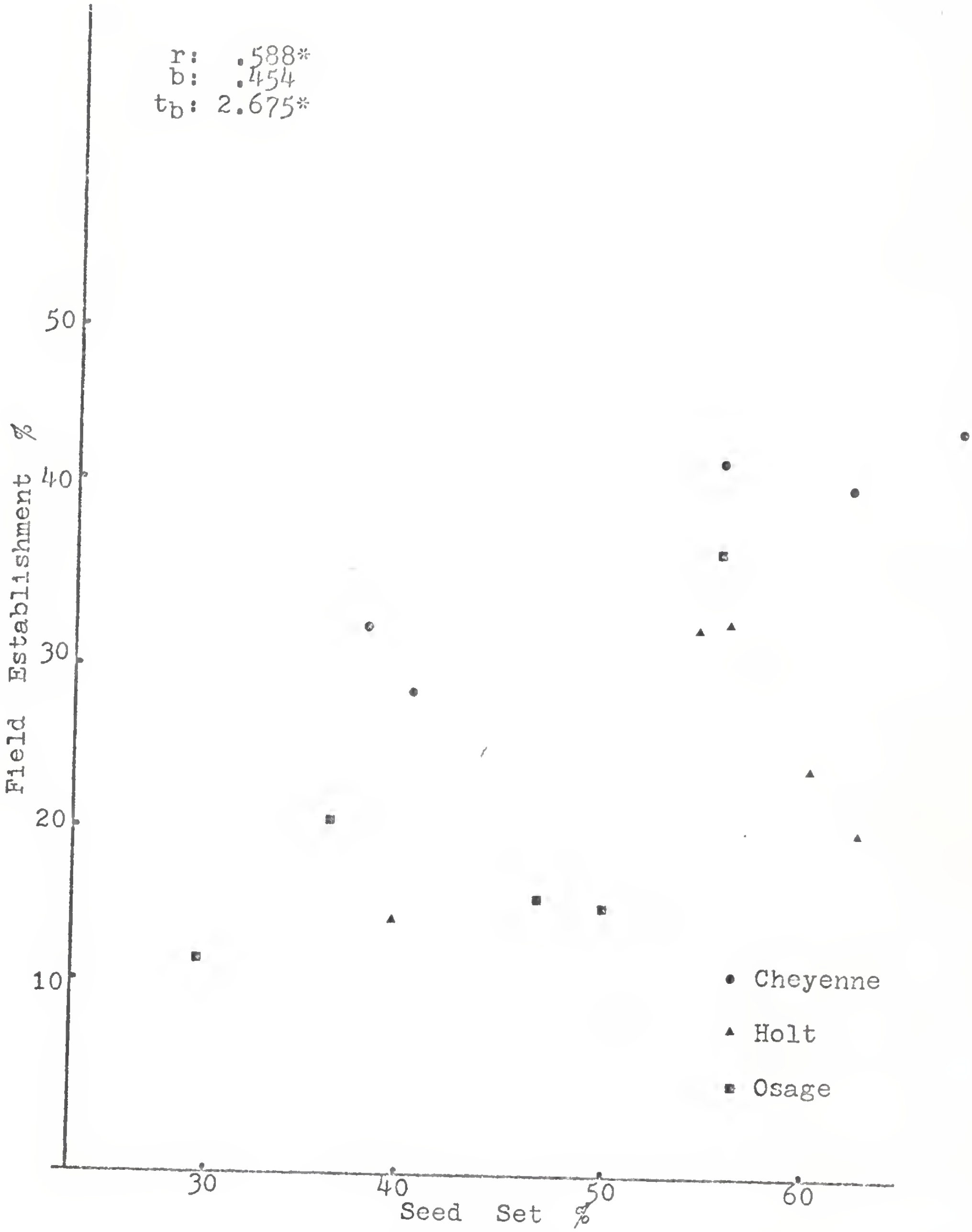

Fig.1 Relationship between seed set and field establishment. Check treatment.

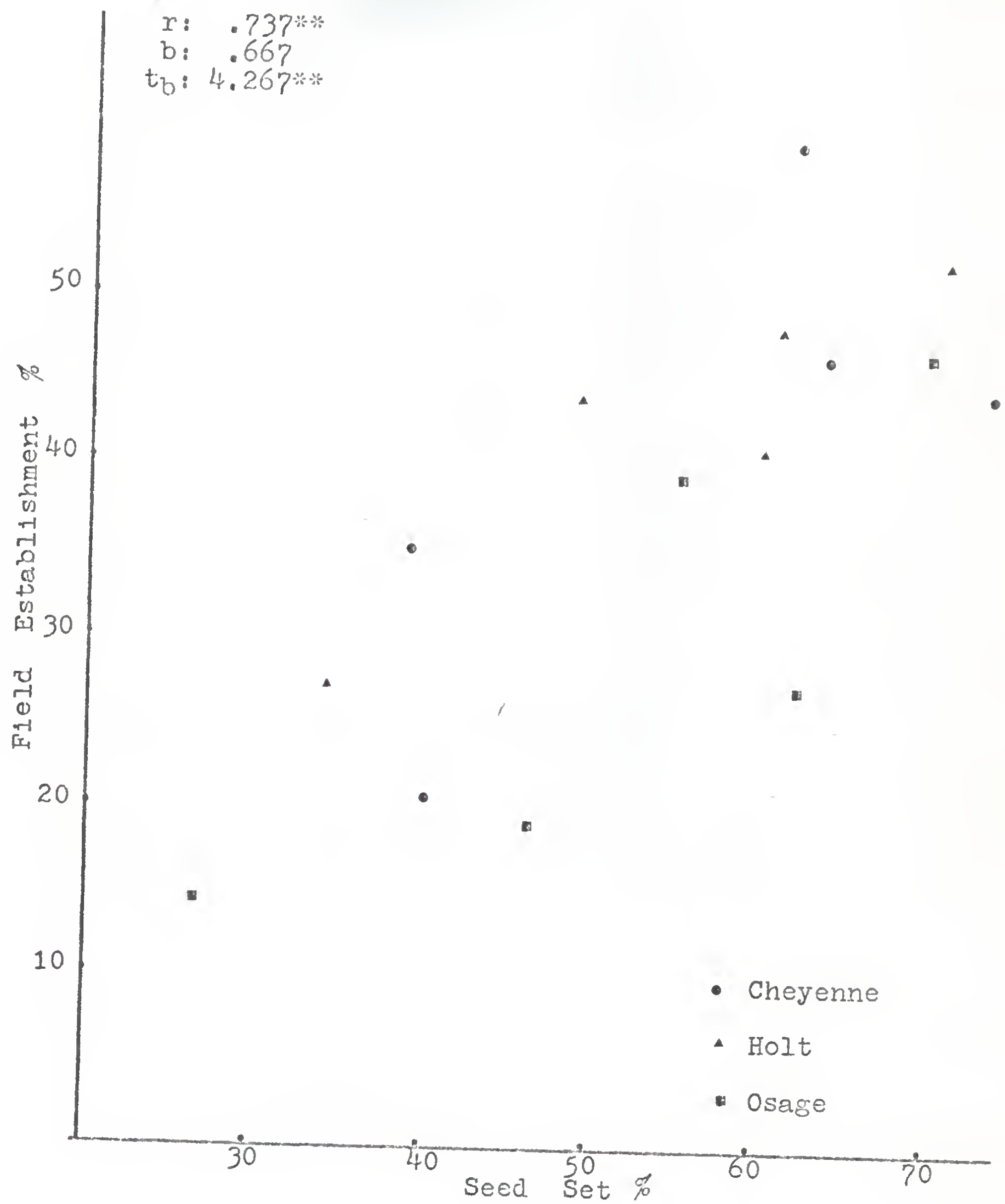

Fig.2 Relationship between seed set and field establishment. Prechill treatment.

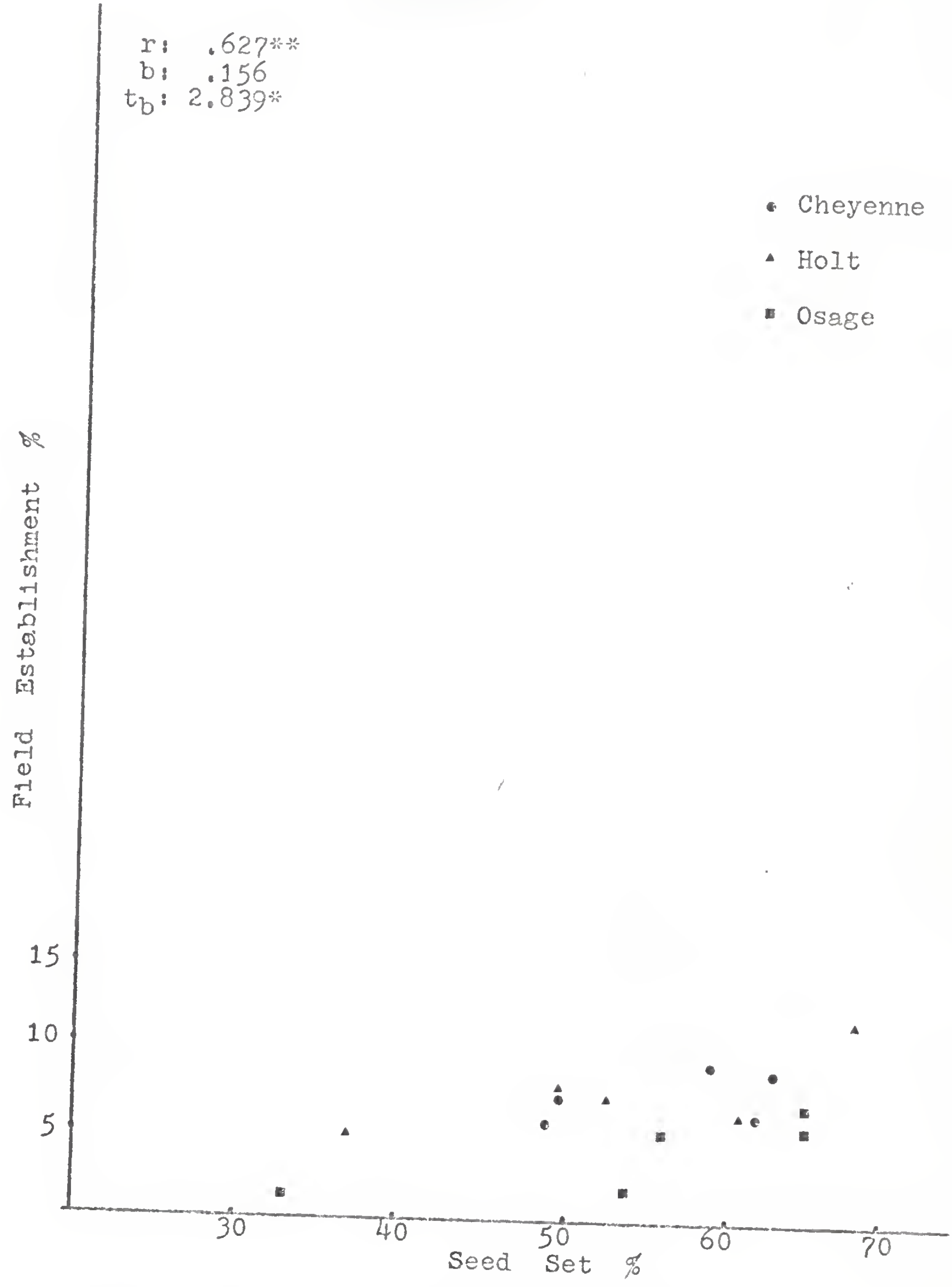

Fig.3 Relationship between seed set and field establishment. Hull removal treatment.

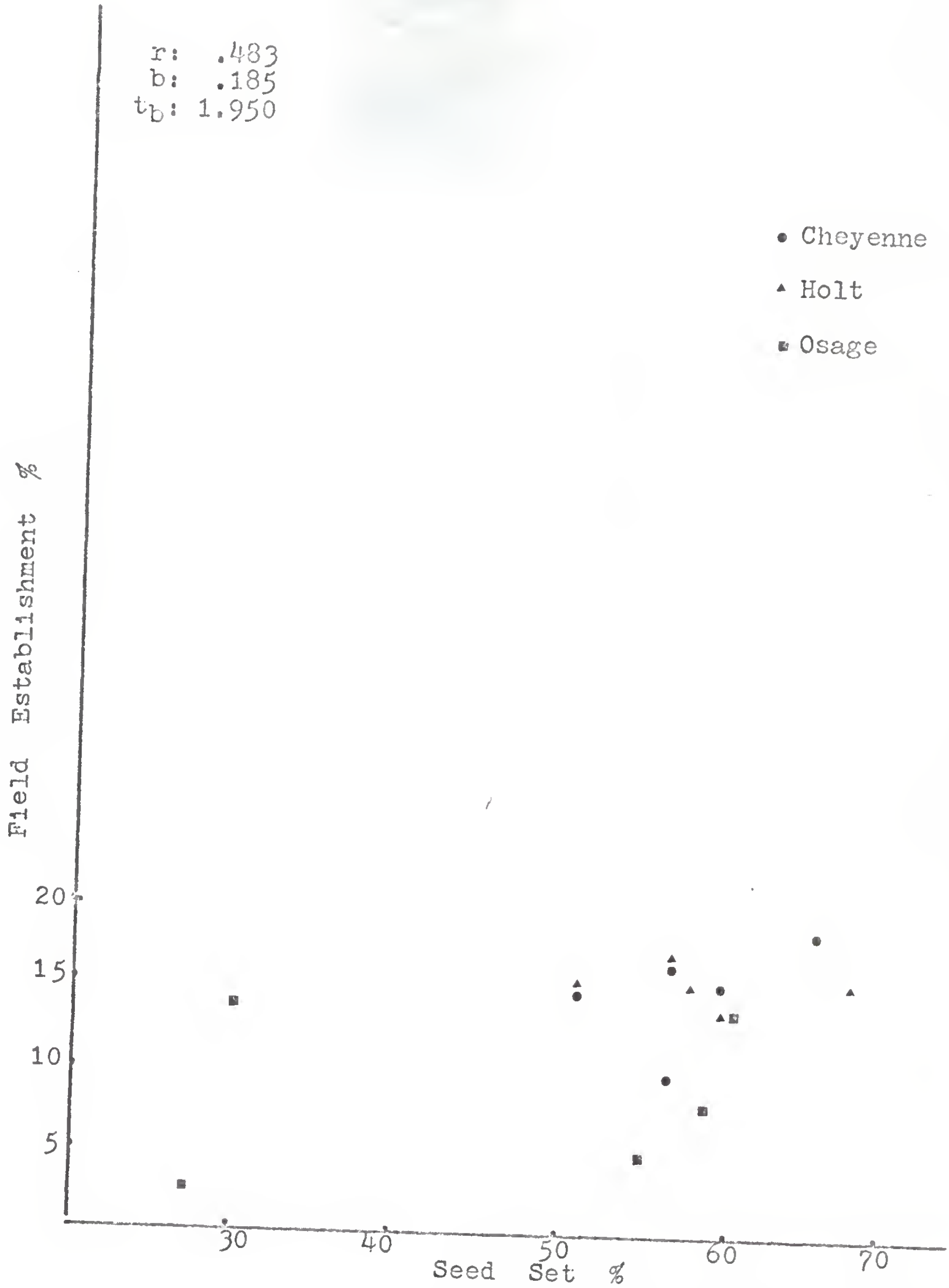

Fig.4 Relationship between seed set and field establishment. Prechill + hull removal treatment.

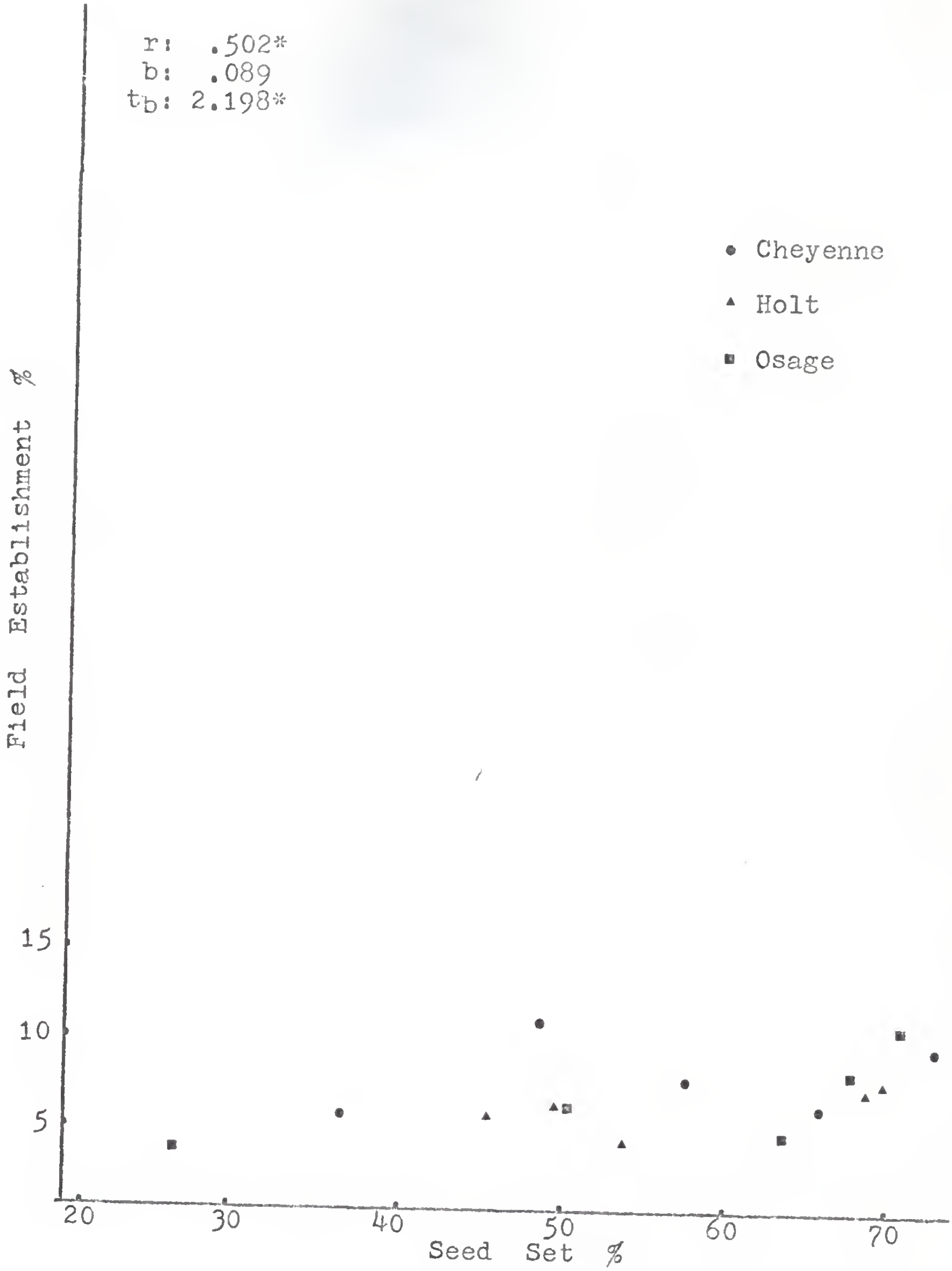

Fig.5 Relationship between seed set and field establishment. Hull removal + prechill treatment.

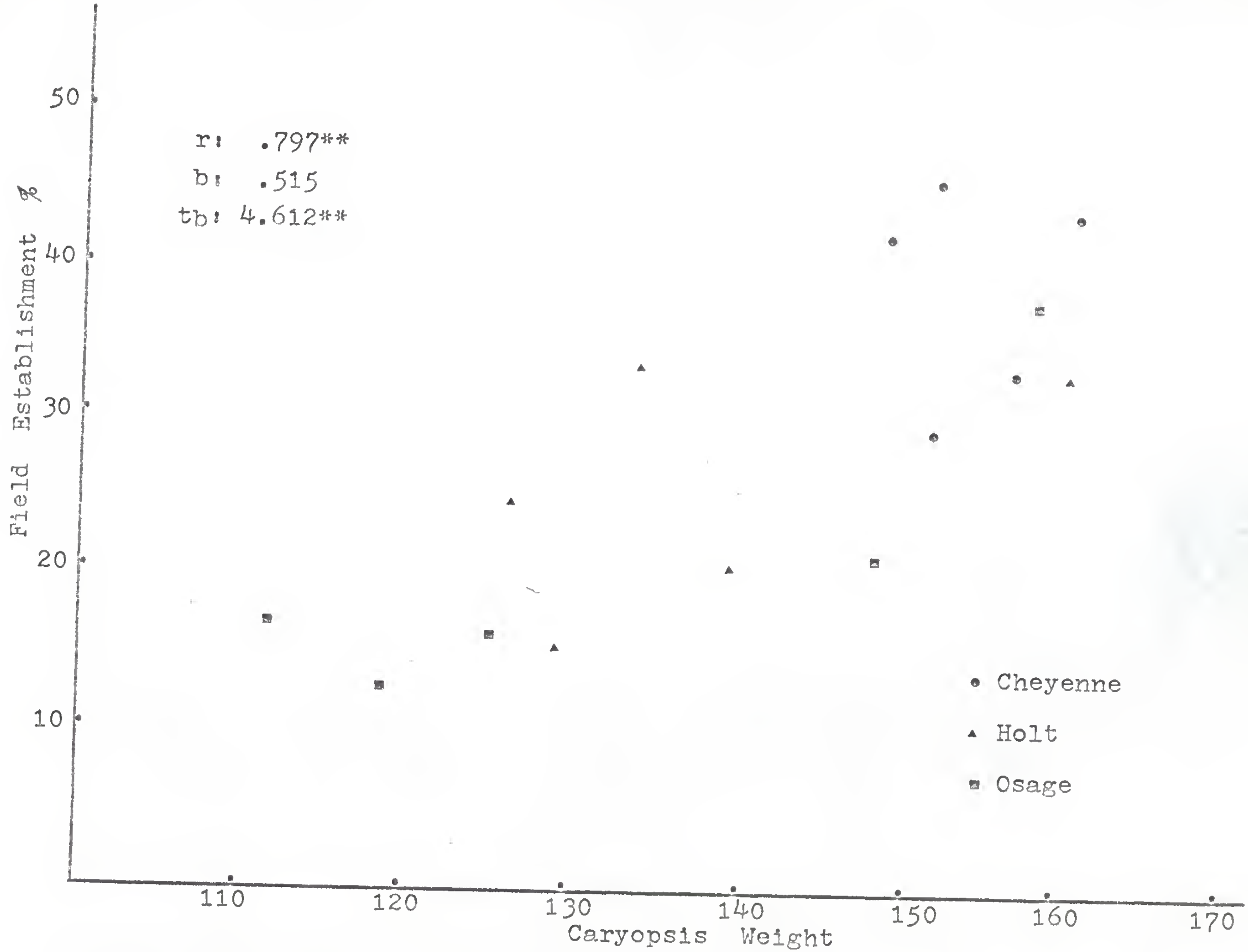

Fig.6 Relationship between caryopsis weight and field establishment. Check treatment.

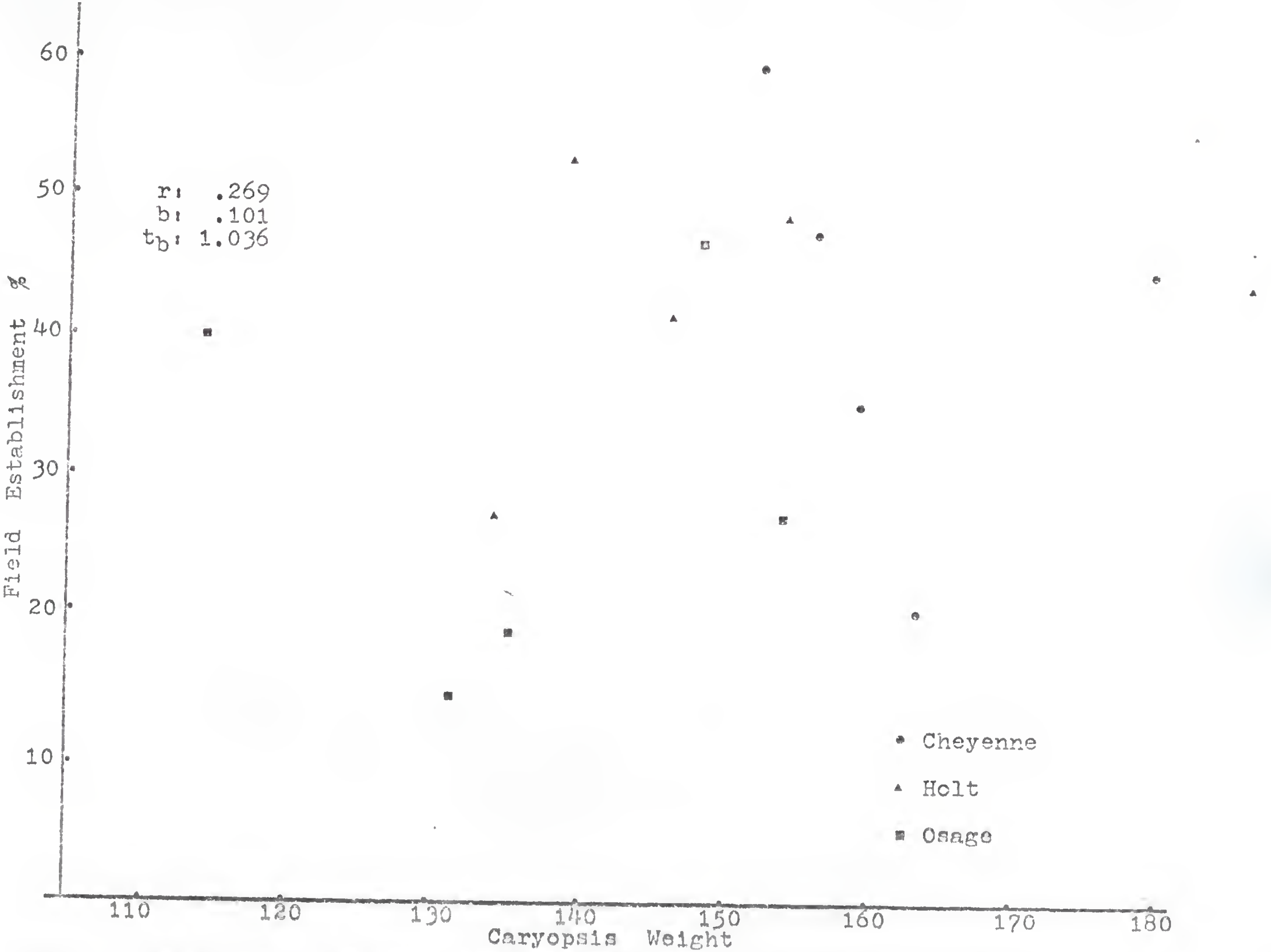

Fig.7 Relationship between caryopsis weight and field establishment. Prechill treatment.

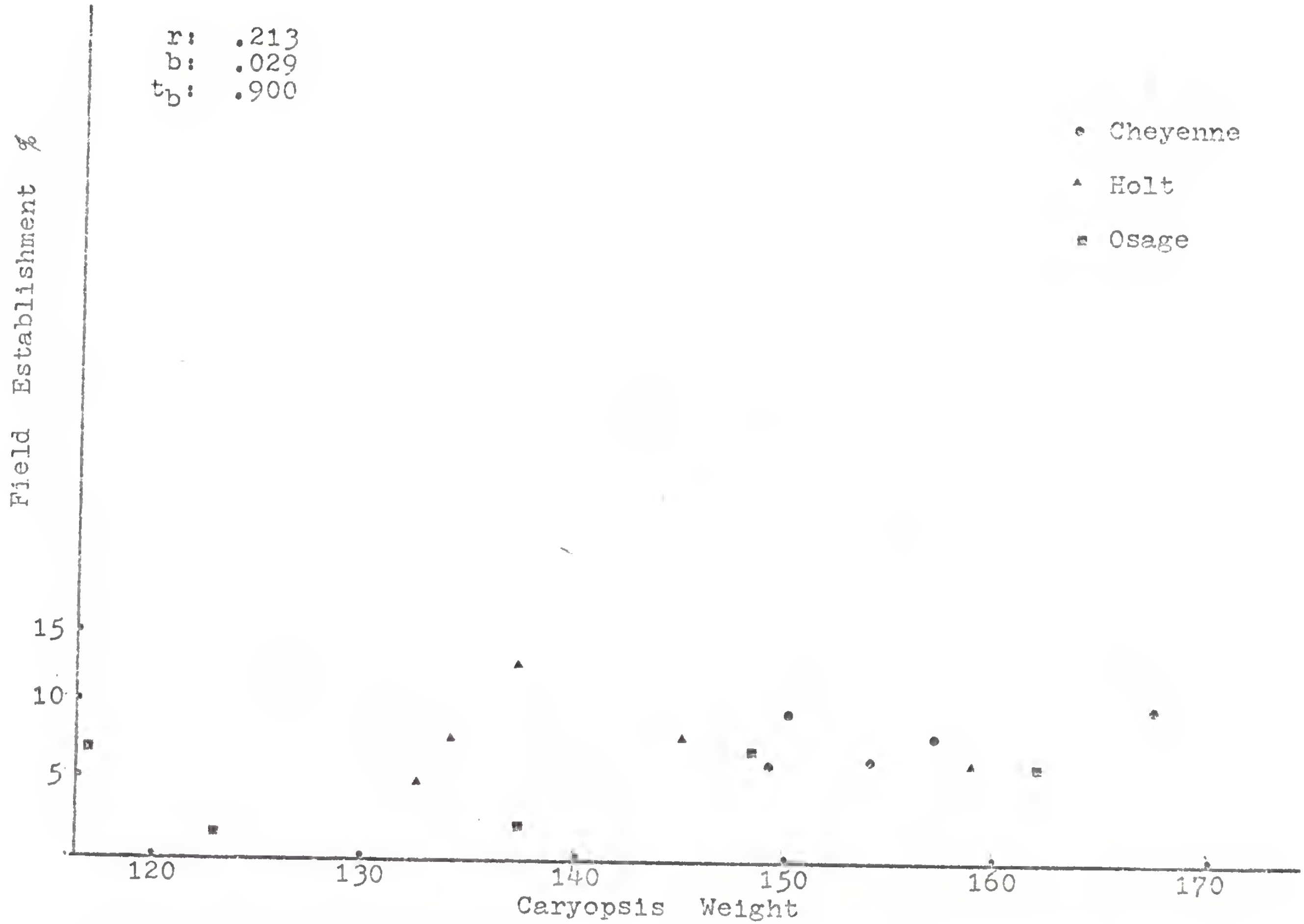

Fig.8 Relationship between caryopsis weight and field establishment. Hull removal treatment.

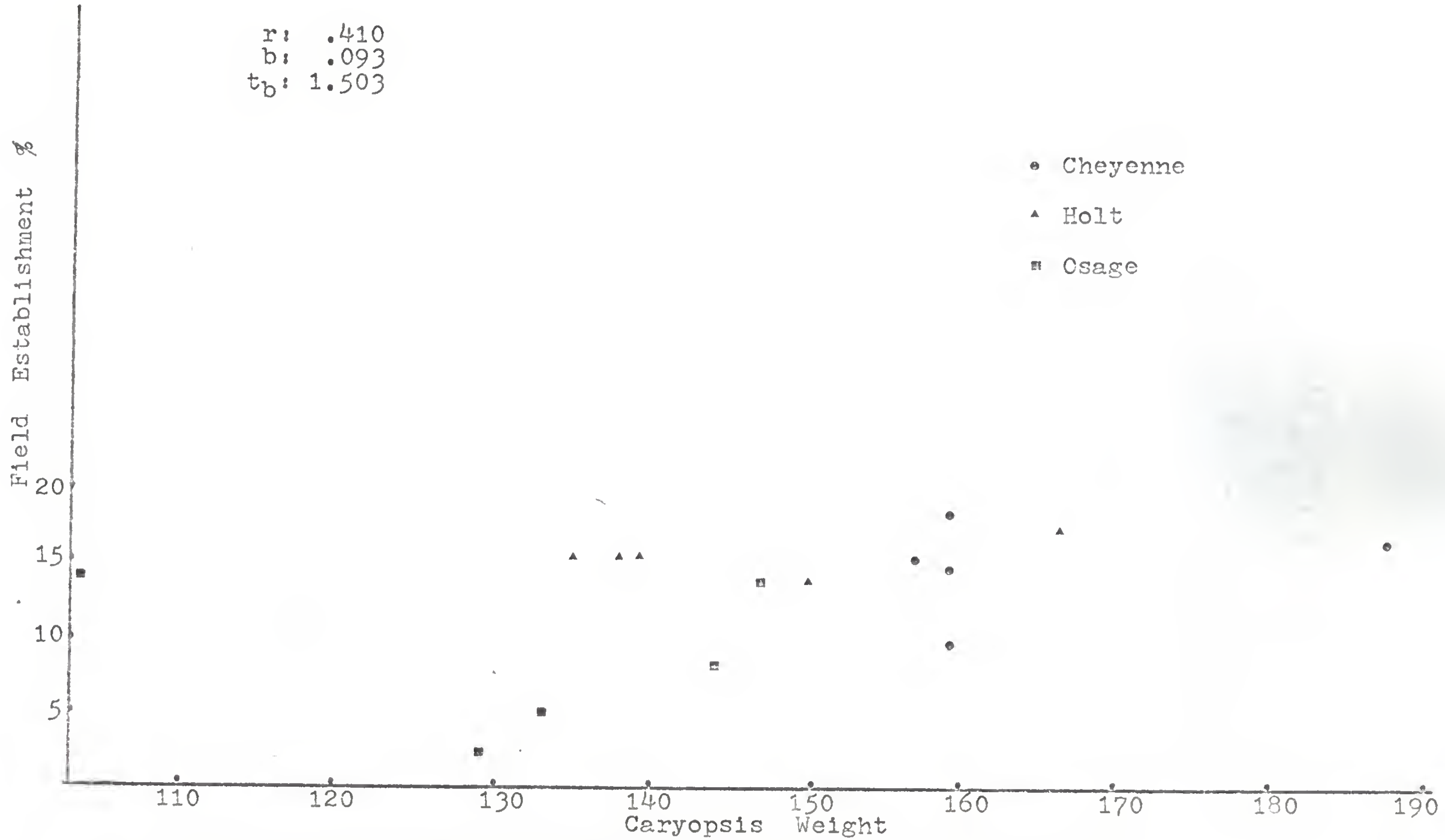

Fig.9 Relationship between caryopsis weight and field establishment. Prechill + hull removal treatment.

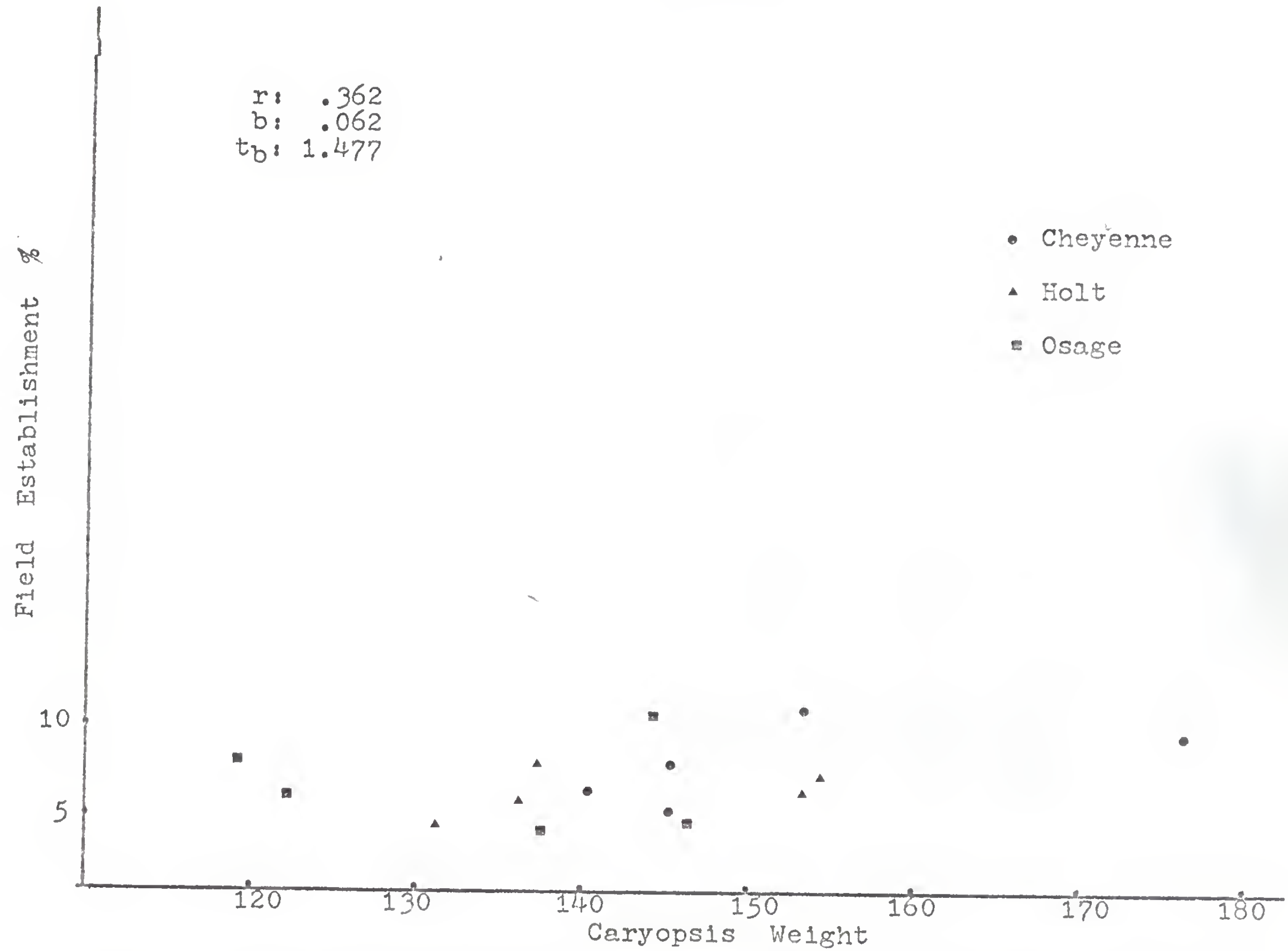

Fig.10 Relationship between caryopsis weight and field establishment. Hull removal + prechill treatment.

EFFECTS OF VARIOUS DORMANCY REDUCING TREATMENTS ON SEED GERMINATION AND ESTABLISHMENT OF INDIANGRASS SORGHASTRUM NUTANS (L.) NASH

by

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B. S., National Taiwan University, 1964

AN ABSTRACT OF A MASTER'S THESIS

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Samples of spikelets of three varieties of indiangrass, Sorghastrum nutans (L.) Nash, were subjected to five dormancy-reducing treatments and subsequently evaluated with respect to laboratory germination, seed set, caryopsis weight, and ability to establish plants in the field.

Seed treatments resulted in highly significant differences in both laboratory germination and field establishment. Compared to the check, all treatments except hull removal followed by prechilling improved normal germination. Only prechilling, however, produced an improvement in field establishment. Field establishment was sharply reduced following treatments involving hull removal. Abnormal laboratory germination followed only treatments involving hull removal. With both check and prechilling treatments, field establishment was considerably higher than normal spikelet germination, indicating occurrence, in the field, of effective dormancy-reducing conditions.

Economic feasibility of prechilling, as a practical means of improving indiangrass establishment was considered questionable, since it seemed likely that establishment increases comparable to those demonstrated could be obtained at lower cost through increase in seeding rate. It was noted, however, that prechilling had not removed all seed dormancy in the laboratory. Therefore, search for more effective dormancy-reducing methods seemed desirable.

Source differences in seed set were nonsignificant at five per cent, but multiple regression indicated that establishment was significantly affected by this variable. Significant source differences occurred in caryopsis weight, and this variable significantly influenced field establishment from untreated spikelets. When dormancy had been reduced through prechilling, however, caryopsis weight had little effect upon establishment.