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BREEDING OF STRAINS OF A-TESTER

YELLOW DENT CORN

THESIS FOR DEGREE OF PH. D.

KUO-MING LIU

1927

Plant-breeding

Farm Crops

BREEDING OF STRAINS OF A-TESTER YELLOW DENT CORN

Thesis

Respectfully submitted in partial fulfillment
for the Degree of Doctor of Philosophy

at

Michigan State College

of

Agriculture and Applied Science

-0-

Kuo-Ming Liu

1927

THESIS

The thesis is a statement of the author's position on a particular subject, and it is the author's responsibility to provide evidence to support this position. The thesis should be clear, concise, and specific, and it should be supported by a well-organized and well-researched argument.

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~~-ACKNOWLEDGMENT-~~

The writer wishes to acknowledge his indebtedness to Professor E. E. Down and Mr. H. M. Brown for their generosity in transferring him the material of the experiment which had been already under way, and their valuable suggestions and thorough criticisms of the following thesis. He is indebted to Mr. F. H. Clark for very helpful suggestions on the manuscript. He is also indebted to Mrs. Marian Brown for corrections of English in the manuscript. Appreciation is due Professor J. F. Cox, Dr. E. A. Bessey, and Dr. R. P. Hibbard for the final review of the thesis.

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INTRODUCTION

The purpose of this work was to develop pure strains of a new corn called "A-tester Yellow Dent" to be used in the production of a possible commercial variety of such corn for the Michigan farmer. Such strains have already been derived by this experiment from crosses made between some of the strains which were used here for the corn breeding work and the A-tester corn of Professor R. A. Emerson of Cornell University. The latter is an inbred white flint corn having the genetic constitution aaCCRRyy, while the former are yellow dent corns whose compositions were found to be either AACcrrYY, or AACcrrYY, or AAccrrYY.

Here A is the anthocyanin factor, dominant to its recessive allelomorph(a), and aids in the development of color in the aleurone layer of the seed when the other factors C and R are present. The C factor dominant over its partner (c) is said to be a chromogen, a basic substance which, when acted on by the enzyme R in presence of A, is oxidized to a red color and to a purple color if another dominant factor, Pr, is present. The seeds, whose aleurone layer is either red or purple, will be termed "colored" in this thesis. If either A, C, or R is lacking, the aleurone layer is colorless, and hence these seeds will be designated as "colorless". Y and y are a factor pair which controls the yellow and white endosperm color, the former being dominant.

These strains of A-tester Yellow Dent corn have the composition

aaCCRR inherited from the A-tester and the yellow dent character (YY) from the mother strains. By having such constitution (aaCCRRYY), they can not escape from observation whenever they are contaminated with any common corn which contains the A factor. If they are pollinated accidentally, by pollen from any common corn in a neighboring field, the hybrid seeds will become colored due to the presence of A, C, and R factors where A comes from the pollen parent whether it has yellow or white endosperm. The hybrid seeds can be eliminated simply by discarding the colored seeds. The colorless ones can then be saved since they are always pure.

As it is now, if a pure yellow variety is contaminated by being pollinated with a white type, the grower can not know the same year that this has actually happened in his corn, as all hybrid seeds are yellow. He will not realize this situation until the next year's crop develops, when he sees a number of white grains appearing in his yellow corn, due to natural chance recombination. Under these circumstances, he will have a very hard time to eradicate all the white seeds because the yellow endosperm character is dominant over or covers up the white one and thus the white seeds will reappear each year whenever the yy condition is effected. His pure variety of yellow corn will deteriorate as seed stock.

Moreover, a contamination like this is a menace to his business, if the farmer is a seed-corn grower, since it will make him lose the confidence of his customers and hence, his market.

Also the contaminated ears, in most cases, could not get the first place or grade in the market and in shows. From this point of view, these newly developed strains, if they produce a promising variety, may benefit the farmer a great deal and solve this difficult problem of contamination.

MATERIALS AND METHODS USED

The work was begun as a problem of the Experiment Station here by the late Professor F. A. Spragg in the year 1923 and was carried on by his associates in 1924 and until all materials were transferred to the writer in the fall of 1925. It is with gratitude that the writer acknowledges his indebtedness to Professor Spragg who was the originator and who laid down the foundation for this work.

Strains used in this investigation as the maternal material are listed in Table I-a. Three strains of M. A. C. (Ac 254), one strain of Michigan White Cap X Bailey (Ac 256), four strains of Duncan (Ac 234), and five strains of Bailey (Ac 128) are yellow dents with red cobs. There are two strains of M. A. C. and one strain of Nelson X Bailey (Ac 255) which are dented, red cobbed, but with red pericarps. One strain of Duncan (Ac 235), and seven strains of M.A.C. (Ac 254) which came from a cross of White Cobbed Golden Glow X White Cobbed Duncan, are yellow dented but white cobbed. All these strains

were inbred or selfed for one or more years before used for this work as is shown in Table I-a.

The A-tester corn, which served as the paternal material, was obtained from Professor Emerson in 1922. It is shown in Table I-b. It is an inbred white flint corn with white cob and has been used by Professor Emerson and his students for testing the aleurone color factors. Its genetic constitution is definitely known as aaCCRR.¹ At the same time, the so-called C-tester and R-tester were also received. These testers have been named for the recessive factor present; consequently, the C-tester would be AAaCCRR, and the R-tester, AACGrr. Both are white dented and white cobbed.

The plant color of this A-tester and of this C-tester was green throughout the plant body. In other words, there was not even a trace of anthocyanic pigment in any part of these plants. It was proved that the A-tester carried the allelomorphic factor $R^G R^G$ as well as aa which causes no pigmentation (pages 67-99). The C-tester was found also to carry $R^G R^G$ and hence it was non-pigmented. Some of the R-tester plants showed some color in stalks, silks, glumes, and anthers, and so they carried $r^R r^R$ which causes such pigment. A few R-tester plants were found to be $r^G r^G$. However, only the R^G factor of the A-tester is concerned in our work later on.

All self- or cross-pollination was carefully controlled.

Bags of 12-pound size, square bottom, 40-pound weight No. 1 Kraft

1. The A-, C-, and R-tester had white endosperms and hence were yy in constitution. Hereafter this endosperm factor will be disregarded unless especially mentioned.

TABLE I-a. Showing the names, accession numbers, selection numbers, plat numbers, kernel color, cob color, years selfed and years intercrossed of the strains used in this investigation.

Source or Name of variety	Access- ion Number	1922 select- ion No.	1923 plat No.	Color of kernel cob	Years selfed	Years inter- crossed
-----Plat ^{or} No.-----						
White Cobbed Duncan	235	02600	30100	yellow white	1920	—
White Cobbed M. A. C.						
White Cobbed Duncan	<u>235</u>	<u>02600</u>	<u>30200</u>	"	"	1921
White Cobbed G. Glow	239	12901		"	"	1922
White Cobbed M. A. C.	" 254	<u>02600</u>	30300	"	"	"
		12904				
" " " "	"	25202	30400	"	"	"
" " " "	"	25203	30500	"	"	"
" " " "	"	25303	30600	"	"	"
" " " "	"	25306	30700	"	"	"
" " " "	"	25312	30800	"	"	"
Red Cobbed " "	"	25205	30900	" red	"	"
" " " "	"	25206	31000	red	"	"
" " " "	"	25207	31100	yellow	"	"
" " " "	"	25302	31200	"	"	"
" " " "	"	25313	31300	red	"	"
Nelson X Bailey	<u>128</u> 233	255 23000	31400	"	"	<u>1917-1919</u> 1920 1921
Michigan White capped X Bailey	<u>128</u> 137	256 23100	31500	yellow	"	<u>1917-1919</u> 1917-1920 "
Red Cobbed Duncan	234	23400	31600	"	"	1920-1922
" " "	"	23701	31700	"	"	"
" " "	"	23705	31800	"	"	"
" " "	"	23802	31900	"	"	"

TABLE I-a continued.

Source or Name of variety	Access- ion Number	1922 select- ion No. or Plat No.	1923 plat No.	Color of kernel	cob	Years selfed	Years inter- crossed
Bailey	128	24101	32000	yellow	red	1917-1919 - 1922	
"	"	24202	32100	"	"	1917-1920 1922	1921
"	"	24204	32200	"	"	1917-1919 1922	
"	"	24301	32300	"	"	1917-1922	
"	"	24302	32400	"	"	1917-1922	

TABLE I-b. Showing names, accession numbers, plat numbers, kernel color and cob color of Emerson's aleurone-color testers.

Name of variety	Accession Number	1923 Plat No.	Color of Kernel	Cob
A-tester	247	32500	white	white
C-tester	248	32600	"	"
R-tester	249	32700	"	"

• *Staphylococcus aureus*

• *Staphylococcus aureus* is a Gram-positive, spherical bacterium that is commonly found on the skin and in the nose. It is a facultative anaerobe, meaning it can grow with or without oxygen. It is a major cause of skin infections, such as abscesses, boils, and impetigo. It can also cause more serious infections, such as pneumonia, sepsis, and food poisoning.

• *Staphylococcus aureus* is a facultative anaerobe, meaning it can grow with or without oxygen. It is a major cause of skin infections, such as abscesses, boils, and impetigo. It can also cause more serious infections, such as pneumonia, sepsis, and food poisoning. It is a Gram-positive, spherical bacterium that is commonly found on the skin and in the nose.

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paper were used for covering the tassels while transparent glassine paper bags (6" x 2 $\frac{1}{2}$ ") were used to cover the ear before the silks emerged. Two men, working together, did the pollinating at the time of crossing and selfing. One man took off the tassel bag with its fresh supply of pollen grains and shook them onto the silks cautiously, as soon as the other man quickly tore off the top of the ear bag. The latter fastened the tassel bag over the ear with No. 3 gem paper clip, while the former labeled the plant, crossed or selfed, with a paper tag. Only one pollination to an ear was made, in order to diminish the chances of contamination. Notes were taken on plant characters and growth in the field.

After harvest counts of colored and colorless kernels on the selfed ears were made in the laboratory and then these ears were classified into groups, according to their Mendelian ratios. Notes were taken on ear characters, such as: color of kernels, color of cobs, length of ear, length of kernels, indentation, circumference of tip and butt, weight of ear, and number of rows, etc. All these notes were entered into the selection book together with the proper selection number of the ear.

It might be well to say here a few words concerning the recording system which is used by this station, in order to help the reader trace the records in this paper. The system consists of three parts, i.e., the accession book, the plant breeding register, and the selection book.

Each crop has its series of accession numbers. Any material

of one variety or one cross collected from one source has an accession number assigned to it according to the order in which it is obtained. In the accession book, besides the accession number, the name of the variety, from whom received, source, date received, and date of entering the nursery, are also recorded for each material.

Before planting time, each lot of seeds from one variety or from one selected ear is registered in the plant breeding register and given a plat number. The plat number consists of five or more figures. The first or left hand figure indicates the year in which the material is harvested. The last, or right hand, two figures designate the number of individual selections, up to 99 which are made in that plat. The digits between the first one and the last two figures indicate the number of that particular plat. For instance, 25306 in Table I-a is the selection number of the sixth selection of plat 53 of the crop year of 1922. If the number of selections exceeds 99, other plat numbers are assigned to that plat to care for the extra selections. In the breeding register, the plat number, the selection number, if any, and the accession number, are all recorded in order to identify the individual material in the test. In the selection book only the individual selection number and accession number are noted. This system has been followed throughout this experiment.

A word of explanation is necessary regarding the methods used in calculating the biometrical constants given in this paper.

The formula used for probable error of a Mendelian ratio is $P. E. = 0.6745/\sqrt{pqn}$, where n is the total number of individuals in the experiment, p is the percent of one member of the ratio, and q is the percent of the other member of that ratio. Thus in a 3:1 ratio, $p = 75\%$ (.75) and $q = 25\%$ (.25); and in a 9:7 ratio, $p = 56.25\%$ (.5625) and $q = 43.75\%$ (.4375) and so forth. The probable error determined by this formula was compared with the actual deviation from the theoretical expectancy.

For tests of closeness of fit in cases where the number of classes was more than two, use was made of the method known as χ^2 suggested by Harris (1912).

For some statistical study in this work the following formulas were used:

$$M = \frac{\sum fV}{n}$$

Here, M = mean; V = a variable; f = class frequency; $\sum$ = summation; n = total number of variables.

$$\sigma = \sqrt{\frac{\sum d^2}{n}}$$

σ = standard deviation; d = deviation from the mean.

$$C.V. = \frac{\sigma}{M} \times 100$$

C.V. = coefficient of variability.

$$E_s = 0.6745 \sigma$$

E_s = probable error of single determination.

$$E_m = \frac{0.6745 \sigma}{\sqrt{n}}$$

E_m = probable error of mean.

$$E_A - B = \sqrt{E_A^2 + E_B^2}$$

$E_A - B$ = probable error of difference between variables A and B if no correlation exists between these two variables.

EXPERIMENTAL RESULTS FROM THE F_1 GENERATION

In the summer of 1923, twenty-four strains of different varieties used as the female parents (P_1) were crossed in the field with the A-tester, which served as the pollen parent. Six crosses were made with each strain. The results are listed in Table II. In the same way these strains were crossed with the C-tester and with the R-tester. Unfortunately, the exact results from these two series of crosses were lost.

As indicated in Table II, all these strains X the A-tester, except one strain, plat 31500, which failed in cross-pollination, resulted in a total of 64 hybrid (F_1) ears all of whose kernels were colored. The color of these F_1 ears was caused by the complementary action of the three dominant aleurone color factors A, C, and R. The factor A in the hybrids must have come from the side of the female parents since the male parent, A-tester, is known to have contributed no A factor but only the C and R factors to its offspring. Therefore, all the female parental strains, used in the test, contained AA in their constitution.

Information¹ obtained indicated that all hybrid ears resulting from crosses between the strains in plats 31400 and 31700 to 32400 with the C-tester (AAccRR) were colorless. Obviously, these strains must have been cc in order to produce the colorless progenies, because A and R without C will not give the colored aleurone

1. Such information was furnished by Mr. H. M. Brown, Research-Assistant in the Farm Crops Department of the Michigan State College.

TABLE II. Showing the number of colored hybrid ears (F_1) which resulted from crosses of the strains used in this experiment with the A-tester, and their F_1 selection numbers.

Source or Name of Variety	Access- ion No.	1923 Plat No. or Female parent	A- tester or male parent	No. of colored ears produced by crosses	Selection No. of F_1 ears
White Cobbed Duncan	235	30100 X	247	2	301150,-151
White Cobbed M.A.C.	254	30200 X	"	2	30255,-56
" " "	"	30300 X	"	3	30331,-32,-33
" " "	"	30400 X	"	2	30408,-09
" " "	"	30500 X	"	3	30513,-14,-15
" " "	"	30600 X	"	2	30604
" " "	"	30700 X	"	2	30702,-03
" " "	"	30800 X	"	2	30806,-07
" " "	"	30900 X	"	1	30904
" " "	"	31000 X	"	3	31008,-09,-10
" " "	"	31100 X	"	3	31111,-12,-13
" " "	"	31200 X	"	5	31203,-04,-05,-06,-07
" " "	"	31300 X	"	4	31306,-07,-08,-09
Nelson X Bailey	255	31400 X	"	3	31430,-31,-32
Mich. Wh. Cap X Bailey	256	31500 X	"	0	- - -
Red Cobbed Duncan	234	31600 X	"	3	31604,-05
" " "	"	31700 X	"	2	31703,-04
" " "	"	31800 X	"	2	31802,-03
" " "	"	31900 X	"	5	31901,-02
Bailey	128	32000 X	"	3	32001,-02
"	"	32100 X	"	2	32101,-02
"	"	32200 X	"	2	32201,-02
"	"	32300 X	"	4	32301,-02
"	"	32400 X	"	4	32407,-08,-09,-10
Total - - - - -					64

in the hybrid seeds. Of the hybrid ears resulting from crosses of the strains in plats 30100 to 31300, 31500, and 31600 with the C-tester, some were all colored and some were only partially colored. This indicated that some of these strains were CC and the other Cc.

The information also stated that these 24 strains X the R-tester (AACCr) resulted in only colorless hybrid ears. Evidently, all these strains lacked the factor R and hence they were rr. The aleurone color can not be produced in this case as only two dominant factors, A and C, were present in the hybrids.

Summing up the above: all these strains used in this investigation are supposed to be of three types - some of them AACCr, some AACrr, and some AAccrr. The whole situation can be understood more clearly by the following factorial diagram, which is in accordance with the above observations and verified by the results of the F₂ and F₃ generations.

Types of these strains used in this investigation.

Paternal parent	Maternal parent		
	AACCr	AACrr	AAccrr
	Progeny		
A-tester - aaCCHR	Colored	Colored	Colored
C-tester - AAccRR	Colored	Half colored Half colorless	Colorless
R-tester - AACCr	Colorless	Colorless	Colorless

BREEDING BEHAVIOR IN THE F₂ GENERATION

Fifty-four F₁ ears were selected. Seeds from these ears were planted in 54 plats and self-pollinated in the summer of 1924. It was found that some of these plats gave ears only with 9:7 ratios or 27:37 ratios of colored to colorless seeds while the other plats gave some ears with 9:7 and other ears with 27:37 ratios of colored to colorless seeds. They are dealt with separately in the following sections.

The 9:7 ratios

Twenty-nine selfed ears from 3 plats were found to have had 9:7 ratios of colored to colorless kernels. The results are given in Table III-a. A total count of segregates on these ears is as follows:

	-Colored-	-Colorless-	-Total-
Observed	6780	5220	12000
Expected	6750	5250	12000
Deviation	+ 30	- 30	0

$$\frac{\text{Dev.}}{\text{P. E.}} = \frac{30.0}{36.6} = 0.8$$

The deviation is only 0.8 times its probable error. Therefore, the observations are very close to expectancy.

The fact can be explained on the theory of complementary factors. It has been pointed out that aleurone color develops only in the presence of all three dominant factors A, C and R. A 9:7 F₂

1. Die Bedeutung der Sprache

Die Sprache ist ein soziales Phänomen. Sie ist ein Instrument, um mit anderen Menschen zu kommunizieren. Sie ist ein Werkzeug, um den eigenen Gedanken auszudrücken. Sie ist ein Medium, um Informationen zu übertragen. Sie ist ein Symbol, um die Welt zu beschreiben. Sie ist ein Zeichen, um die eigene Identität zu markieren. Sie ist ein Werkzeug, um den eigenen Willen durchzusetzen. Sie ist ein Instrument, um den eigenen Standpunkt zu vertreten. Sie ist ein Medium, um den eigenen Standpunkt zu vertreten. Sie ist ein Symbol, um den eigenen Standpunkt zu vertreten. Sie ist ein Zeichen, um den eigenen Standpunkt zu vertreten.

2. Die Funktion der Sprache

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3. Die Entwicklung der Sprache

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$$A = B \rightarrow C = D$$

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ratio should result when the F_1 is heterozygous for two factors. One recessive factor (a) naturally comes from the male parent, A-tester (aaCCRR), and the other (r) from the female parent. The constitution of the mother strains (P_1) must have been AACcrr in this case, whence the F_1 genotype was AaCCRr. Theoretically, when such an ear is self-pollinated, on the F_2 ear 9 kernels, having all the dominant factors, would be colored, and 7 kernels would be colorless, since only one or two or no dominant factors were present.

The 27:37 ratios

Two hundred and five F_2 ears from 28 plats exhibited a 27:37 ratio of colored to colorless seeds. The results are summarized in Table III-b. The total number of seeds on these ears is given below:

	-Colored-	-Colorless-	-Total-
Observed	33823	46510	80333
Expected	33890.5	46442.5	80333
Deviation	-67.5	+ 67.5	0

$$\frac{\text{Dev.}}{\text{P. E.}} = \frac{67.5}{94.4} = 0.7$$

The deviation is only 0.7 times its probable error. Obviously, observations accord with expectations very well. Explained on the theory of three complementary factors, the F_1 genotype should be heterozygous for the three aleurone factors, i.e., AaCcRr. Here the recessive factor (a) obviously comes from the A-tester (aaCCRR), and (c) and (r) from the mother strains (P_1) which must be AACcrr in this

TABLE III-a. Showing the lots which produced only F₂ ears with 9:7 ratios of colored to colorless kernels. These ears resulted from the F₁ genotype AaCCRR (AACCr X aaCCRR).

Name of Variety	Access- ion No.	F ₁ 1923 Selection No.	F ₂ 1924 Plat No.	Number of 9:7 ears
M.A.C. Yellow Dent	254	30331	41100	20
" " "	"	30513	41600	5
" " "	"	31203	43100	4
Total	- - - - -	- - - - -	- - - - -	29

TABLE III-b. Indicating the plats which produced only F₂ ears with 27:37 ratios of colored to colorless kernels. These ears resulted from the F₁ genotype AaCaRr (AAccrr X aaCCRR).

Name of Variety	Access- ion No.	F ₁ 1923 Selection No.	F ₂ 1924 Plat No.	Number of 27:37 ears
White Cobbed Duncan	235	301150	40700	11
M.A.C. Yellow Dent	254	30255	40900	2
" " "	"	30703	42100	3
" " "	"	31111	42800	5
" " "	"	31113	43000	4
" " "	"	31207	43500	7
" " "	"	31306	43600	3
" " "	"	31307	43700	3
" " "	"	31309	43900	21
Nelson X Bailey	255	31430	44000	6
" " "	"	31431	44100	7
" " "	"	31432	44200	8

TABLE III-b (continued).

Name of Variety	Accession No.	F ₁ 1923 Selection No.	F ₂ 1925 Plat No.	Number of 27:37 Bars
Red Cobbed Duncan	234	31605	44400	3
" " "	"	31703	44500	8
" " "	"	31704	44600	14
" " "	"	31802	44700	19
" " "	"	31803	44800	14
" " "	"	31901	44900	6
" " "	"	31902	45000	5
Bailey	128	32001	45100	2
"	"	32002	45200	4
"	"	32101	45300	12
"	"	32201	45500	17
"	"	32202	45600	9
"	"	32301	45700	2
"	"	32302	45800	2
"	"	32407	45900	2
"	"	32408	46000	6
Total - - - - -				205

case. When such an F_1 genotype is self-pollinated, on an F_2 ear 27 kernels, having all three dominant factors, would be colored, and 37, having at least one homozygous recessive pair of aleurone factors, would be colorless.

The 9:7 and 27:37 ratios

Twenty-one plats, each from a single F_1 ear, produced ears with 9:7 ratios and ears with 27:37 ratios of colored to colorless seeds. Out of 200 such F_2 ears, 101 were found to have 9:7 ratios, 99 to have 27:37 ratios. The results are summarized in Table III-c. Counts for these two sorts of ears gave the following numbers of kernels:

	-From 101 9:7 F_2 ears-			-From 99 27:37 F_2 ears-		
	-Colored-	-Colorless-	-Total-	-Colored-	-Colorless-	-Total-
Observed	20834.	15958.	36792	18215.	24588.	42802
Expected	20695.5	16096.5	36792	18057.5	24745.5	42802
Deviation	+138.5	-138.5	0	+157.5	-157.5	0
<u>Dev.</u>	$= \frac{138.5}{64.2} = 2.2$			$= \frac{157.5}{68.95} = 2.3$		
P.E.						

The deviation for the first lot is 2.2 times its probable error and thus indicates a 9:7 Mendelian ratio. The deviation for the second lot is only 2.3 times its probable error, obviously indicating a 27:37 ratio.

Glancing at Table III-c, it is interesting to note that 9:7 ears and 27:37 ears, which occurred in each plat, were in equal numbers. A calculation on this basis for the total number of ears in the 21 plats shows a deviation of 1, which is only 0.2 times its probable

TABLE III-c. Showing the plats which produced both 9:7 and 27:37 F₂ ears. They resulted from the F₁ genotypes AaCCRR and AaCcRr which occurred on the same ear (AaCcrr X aaCCRR).

Name of Variety	Accession No.	F ₁ 1923 Selection No.	F ₂ 1923 plat No.	Actual No. of ears in		Theoretical No. of ears (1:1) in		Dev. P.E.		Dev. P.E.
				9:7	27:37	9:7	27:37			
Wh. Cobbed Duncan	235	301151	40800	4	3	3.5	3.5	0.5	0.9	0.6
M. A. C.	254	30256	41000	4	9	6.5	6.5	2.5	1.2	2.1
" "	"	30332	41200	12	4	8.0	8.0	4.0	1.4	2.9
" "	"	30333	41300	3	11	7.0	7.0	4.0	1.3	3.1
" "	"	30408	41400	9	7	8.0	8.0	1.0	1.4	0.7
" "	"	30409	41500	4	7	5.5	5.5	1.5	1.1	1.4
" "	"	30514	41700	5	6	5.5	5.5	0.5	1.1	0.5
" "	"	30515	41800	7	9	8.0	8.0	1.0	1.4	0.7
" "	"	30604	41900	1	4	2.5	2.5	1.5	0.7	2.0
" "	"	30702	42000	2	1	1.5	1.5	0.5	0.6	0.9
" "	"	30806	42200	4	3	3.5	3.5	0.5	0.9	0.5
" "	"	30904	42400	1	5	3.0	3.0	2.0	0.8	2.5
" "	"	31008	42500	8	13	10.5	10.5	2.5	1.5	1.7
" "	"	31009	42600	4	4	4.0	4.0	0.0	0.9	0.0
" "	"	31011	42700	7	7	7.0	7.0	0.0	1.2	0.0
" "	"	31112	42900	4	1	2.5	2.5	1.5	0.7	2.0
" "	"	31204	43200	3	2	2.5	2.5	0.5	0.7	0.7
" "	"	31205	43300	2	4	3.0	3.0	1.0	0.8	0.1
" "	"	31206	43400	5	1	3.0	3.0	2.0	0.8	2.5
" "	"	31308	43800	5	2	3.5	3.5	1.5	0.9	1.5
Red Cob. Duncan	234	31604	44300	8	6	7.0	7.0	1.0	1.3	0.7
Total				-101	99	100.0	100.0	1.0	4.7	0.2

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error. This leads to the conclusion that the F_1 genotypes from which these F_2 ears resulted must have been of two sorts, $AaCCRr$, and $AaCcRr$, but all look alike, i.e. all are colored. Therefore, their parental (P_1 or mother strain) constitution must have been $AACcrr$. When crossed with the A -tester ($aaCRRR$), two types of gametes, ACr and Acr in equal numbers from this female parent were fertilized by the gametes, aCR , from the A -tester. When self-pollinated, the genotype $AaCCRr$ produced 9:7 F_2 ears, while the genotype $AaCcRr$ produced 27:37 F_2 ears, in proportion of 1:1.

Summing up the above: the hypothesis fits all observations in this generation very well, and also verifies the results of the F_1 generation. It is further verified by the F_3 generation.

THE CONSTITUTION OF THE STRAINS USED IN THIS INVESTIGATION

Emerson (1918) has pointed out that all corn varieties which he tested were rr . In other words, they lacked the R factor. Likewise all varieties were found to be AA except two, one grown locally in Southern Missouri and the other in Ohio. There is apparently greater diversity with respect to the C factor. Some of the varieties are apparently CC , thus being R -testers, while some are Cc and others cc , and yet others a mixture of these types.

It has been found that all strains which have been tested in this experimental work were AA and rr but were inconsistent with regard to the C factor, conclusions which coincide with Emerson's findings. The results are arranged in Table IV, which is in

pedigree form. By it the female parents and their progenies in the F_1 and F_2 generations can be traced in either direction. The genetic constitution of these maternal P_1 strains was determined by the breeding behaviors of progenies of the F_1 and F_2 generations. Glancing at Table IV, one will see that strains of White Cobbed Duncan (Ac 235) and Red Cobbed Duncan (Ac 234) had the constitution of AACerr or AACerrr. Strains of M. A. C. (Ac 254) had AACCrr, AACerr or AACerrr. This diversity of the Cc factor pair may be due to the fact that some of the strains had been either crossed or intercrossed and self-pollinated previous to this investigation. For such information the reader is referred to Table I-a. The strains with Cc in composition would keep on segregating in a simple Mendelian fashion (3C:1c), whenever they were self-fertilized. Probably this is what has actually happened in nature, and has kept nearly all common corn varieties so diverse with regard to the C factor. For some unknown reason such heterozygous condition has been rarely found for the A and r factors.

Bailey (Ac 128) and Nelson X Bailey (Ac 255) have the constitution AACerrr.

BREEDING BEHAVIOR IN THE F_3 GENERATION

For the 1925 (F_3) planting eighty-one F_2 ears were selected; of these 29 had 9:7 ratios and 52 had 27:37 ratios. Only colored

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TABLE IV. Genetic constitution of the maternal P₁ strains used in this investigation.

Name of Variety	Accession No.	P ₁ 1922 selection No.	F ₁ 1923 selection No.	F ₂ 1924 plat No.	Genetic constitution
Wh. Cob. Duncan	235	02600	301150	40700	AAccrr
			301151	40800	AAccrr
Wh. Cob. Duncan		<u>02600</u>	30255	40900	AAccrr
Wh. Cob. G. Glow	254	12901			
M.A.C.			30256	41000	AAccrr
		<u>02600</u>	30331	41100	AAccrr
		12904	30332	41200	AAccrr
			30333	41300	"
		25202	30408	41400	"
			30409	41500	"
		25203	30513	41600	AAccrr
			30514	41700	AAccrr
			30515	41800	"
		25303	30604	41900	"
		25306	30702	42000	"
			30703	42100	AAccrr
		25312	30806	42200	AAccrr
		25205	30904	42400	"
		25206	31008	42500	AAccrr
			31009	42600	"
			31011	42700	"
		25207	31111	42800	AAccrr
			31112	42900	AAccrr

TABLE IV. (continued)

Name of Variety	Access- ion No.	P ₁ 1922 selection No.	F ₁ 1923 selection No.	F ₂ 1924 Plat No.	Genetic constitution

M. A. C. (continued)	254		31113	43000	AAcerr
		25302	31203	43100	AAcCrr
			31204	43200	AAcCrr
			31205	43300	"
			31206	43400	"
			31207	43500	AAcerr
		25313	31306	43600	"
			31307	43700	"
			31308	43800	AAcCrr
			31309	43900	"
Nelson X Bailey	255	23000	31430	44000	AAcerr
			31431	44100	"
			31432	44200	"
		23400	31604	44300	AAcCrr
			31605	44400	"
Red Cob. Duncan	234	23701	31703	44500	AAcerr
			31704	44600	"
		23705	31802	44700	"
			31803	44800	"
		23802	31901	44900	"
Bailey	128		31902	45000	"
		24101	32001	45100	"
			32002	45200	"
		24202	32101	45300	"
		24204	32201	45500	"
			32202	45600	"
		24301	32301	45700	"
		24302	32302	45800	"
			32407	45900	"
			32408	46000	"

kernels from the two groups were planted and selfed in the field, while the colorless ones from such ears were discarded. The reason for planting the colored individuals and discarding the colorless ones is that the strains of the A-tester yellow dent corn can be derived more easily from the former than from the latter in terms of possibility and economy of work. Theoretically only 1 out of 7 or 37 colorless kernels on a 9:7 or 27:37 ear, respectively, is the A-tester type, while out of 9 or 27 colored kernels from the 9:7 or 27:37 ear, 4 or 6 will, when self-pollinated, produce 3:1 ears of which one-half or one-third of the colorless kernels will be the A-tester types looked for. (See factorial diagrams on pages 23 and 26.) Therefore, using the colored individuals of F_2 ears will save the plant breeder more time and will give him more chance or possibility of developing strains of the A-tester yellow dent corn than if he uses the colorless ones.

Segregations for aleurone color of all individual F_3 ears were counted. All these ears have been grouped into two groups, i.e. those resulting from the 9:7 F_2 ears and those resulting from the 27:37 F_2 ears. Each group has shown similar consistent results.

Results of progenies from the 9:7 F_2 group

Three kinds of Mendelian ratios for F_3 ears have been found in any plat of this group. In each plat, some ears had 1:0, some had 3:1, and others had 9:7 ratios of colored to colorless seeds. A summary of data for this group is set forth in Table V-a.

Theoretically, colored seeds of any 9:7 F_2 ear, if from a cross of $\Delta\Delta CCrr$ X $aaCCRR$, should act in the following manner when they are selfed in the F_3 generation.

$-F_2$ genotypes-	-Breeding behavior in F_3 -	-Phenotypic Proportion of F_3 ears-
1 $\Delta\Delta CCRR$	1:0 (only colored) breeds true	1
2 $\Delta aCCRR$	3 colored: 1 colorless ($aaCCRR$) (Δ -tester type)	4
2 $\Delta\Delta CCrr$	3 colored: 1 colorless ($\Delta\Delta CCrr$) (R-tester type)	4
4 $\Delta aCCrr$	9 colored: 7 colorless	4

Such was proved to be the case by the actual observations. As seen from Table V-a, the numbers of ears in each plat with these three different Mendelian ratios were in the proportion of 1:4:4. Values of X^2 for most plats were less than 1, hence the value for closeness of fit (P) is very high. Evidently observations are very close to expectation. The total numbers of actual and expected ears of these classes from 29 plats are given below:

Ratio	1:0	3:1	9:7
Observed total	53.0	233.0	230.0
Expected total	57.3	229.3	229.3
Deviation	-4.3	+ 3.7	- 0.7

X^2 for total = 0.3880 P = very close fit.

There were two kinds of 3:1 ears: one resulted from the F_2 genotype $\Delta aCCRR$, and the other resulted from the F_2 genotype $\Delta\Delta CCrr$. The first kind of 3:1 ears is the one which has been looked for by this experiment, because its colorless seeds are the Δ -tester type

TABLE V-a. Number of F_3 ears, resulting from colored individuals of 9:7 F_2 ears, showing 1:0, 3:1 and 9:7 ratios.

F ₂ 1924 Selection No.	F ₃ 1925 Plat No.	Actual			Theoretical			X ²	Closeness of fit (P)
		No. of ears			No.(1:4:4) of ears				
		with ratios of			with ratios of				
		1:0	3:1	9:7	1:0	3:1	9:7		
44304	51600	0	3	6	1.0	4.0	4.0	2.2500	0.3318
40607	53400	2	8	9	2.1	8.4	8.4	0.0658	Very good
41102	53900	3	17	12	3.6	14.2	14.2	0.9766	" "
41109	54000	3	7	8	2.0	8.0	8.0	0.6250	" "
41113	54100	2	18	13	3.7	14.7	14.7	2.4620	0.3011
41114	54200	2	5	7	1.6	6.2	6.2	0.4642	Very good
41118	54300	3	10	7	2.2	8.8	8.8	0.8125	" "
41119	54400	2	6	7	1.7	6.7	6.7	0.1502	" "
41201	54500	2	13	6	2.3	9.3	9.3	3.1070	0.2137
41211	54600	3	11	10	2.7	10.7	10.7	0.0937	Very good
41212	54700	2	7	9	2.0	8.0	8.0	0.2500	" "
41216	54900	4	11	9	2.7	10.7	10.7	0.9375	" "
41311	55000	3	7	11	2.3	9.3	9.3	1.0714	0.5895
41409	55400	3	10	8	2.3	9.3	9.3	0.4286	Very good
41413	55500	1	13	10	2.7	10.7	10.7	1.5938	0.4648
41503	55600	1	11	9	2.3	9.3	9.3	1.0712	0.5896
41512	55900	1	11	10	2.4	9.8	9.8	0.8739	Very good
41602	56000	3	7	6	1.8	7.1	7.1	1.0156	0.6028
41604	56100	1	6	6	1.4	5.8	5.8	0.1453	Very good
41605	56200	1	7	6	1.6	6.2	6.2	0.3752	" "

1. The first part of the report is a general introduction to the project, which is a study of the effects of the new tax system on the distribution of income and wealth in the United Kingdom.

2. The second part of the report is a detailed analysis of the data collected for the study. This includes a description of the sample, the methods used to collect the data, and the results of the analysis.

3. The third part of the report is a discussion of the results of the study, and a conclusion about the effects of the new tax system on the distribution of income and wealth.

4. The fourth part of the report is a list of references, which includes a list of the books and articles that were consulted during the study.

5. The fifth part of the report is a list of tables, which includes a list of the tables that are included in the report.

6. The sixth part of the report is a list of figures, which includes a list of the figures that are included in the report.

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9. The ninth part of the report is a list of footnotes, which includes a list of the footnotes that are included in the report.

10. The tenth part of the report is a list of acknowledgments, which includes a list of the people and organizations that helped with the study.

11. The eleventh part of the report is a list of the authors, which includes a list of the names of the people who wrote the report.

12. The twelfth part of the report is a list of the titles of the chapters, which includes a list of the titles of the sections of the report.

13. The thirteenth part of the report is a list of the titles of the sections, which includes a list of the titles of the subsections of the report.

14. The fourteenth part of the report is a list of the titles of the subsections, which includes a list of the titles of the subsubsections of the report.

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16. The sixteenth part of the report is a list of the titles of the subsubsubsections, which includes a list of the titles of the subsubsubsubsections of the report.

17. The seventeenth part of the report is a list of the titles of the subsubsubsubsections, which includes a list of the titles of the subsubsubsubsubsections of the report.

18. The eighteenth part of the report is a list of the titles of the subsubsubsubsubsections, which includes a list of the titles of the subsubsubsubsubsubsections of the report.

TABLE V-a (continued)

F ₂ 1924 Selection No.	F ₃ 1925 Plat No.	Actual No. of ears with ratios of			Theoretical No. (1:4:4) of ears with ratios of			X ²	Closeness of fit (P)
		1:0	3:1	9:7	1:0	3:1	9:7		
41701	56300	1	6	10	1.9	7.6	7.6	1.5293	0.4802
41708	56500	1	6	6	1.4	5.8	5.8	0.1453	Very good
41802	56600	3	6	9	2.0	8.0	8.0	1.1250	0.5767
41810	56700	1	3	10	1.6	6.2	6.2	4.1605	0.1268
41904	57000	2	6	5	1.4	5.8	5.8	0.3227	Very good
42203	57300	1	6	4	1.2	4.9	4.9	0.4544	" "
42208	57400	1	4	5	1.1	4.4	4.4	0.1249	" "
42505	57700	2	4	7	1.4	5.8	5.8	1.0192	0.6020
42708	58100	2	5	9	1.8	7.1	7.1	1.1561	0.5693
29 plats									
Total	- - - - -	53	233	230	57.3	229.3	229.3	0.3880	Very good

Date		Time		Location		Remarks		Signature	

which has the constitution of aaCCRR and from which the strains of the A-tester yellow dent will be derived. Colorless seeds of the other kind of 3:1 ears are the R-tester type (AACCrR). Since these two kinds of 3:1 ears all look alike, they must be separated from each other by a method which will be dealt with later on.

Results of progenies from the 27:37 F₂ group

Plants grown from colored seeds of any 27:37 F₂ ear bred differently in F₃, as was expected. In nearly every plat were found F₃ ears with 1:0, 3:1, 9:7, and 27:37 ratios of colored to colorless seeds, but 1:0 ears did not appear in some plats, since they occur theoretically only once in 27 cases. The results are listed in Table V-b. On the theory of complementary factors, the 27 F₂ colored individuals, when selfed, will produce the following types and in the following proportion in F₃.

-F ₂ genotypes-	-Breeding behavior in F ₃ -	-Proportion of F ₃ phenotypes-
1AA CCRR	1:0 (only colored) breeds true	1
2Aa CCRR	3 colored: 1 colorless (aaCCRR) (A-tester type)	
2AA CcRR	3 colored: 1 colorless (AAccRR) (C-tester type)	6
2AA CCrr	3 colored: 1 colorless (AACCrR) (R-tester type)	
4Aa CCrr	9 colored: 7 colorless	
4Aa CcRR	9 colored: 7 colorless	12
4AA CcRr	9 colored: 7 colorless	
8Aa CcRr	27 colored: 37 colorless	8

TABLE V-b. Number of F_3 ears, resulting from colored individuals of 27:37 F_2 ears, showing 1:0, 3:1, 9:7 and 27:37 ratios.

F_2 1924 Selec- tion No.	F_3 1925 Plat No.	Actual No. of ears with ratios of				Theoretical No. (1:6:12:8) of ears with ratios of				χ^2	Close- ness of fit (P)
		1:0	3:1	9:7	27:37	1:0	3:1	9:7	27:37		
45502	51200	0	5	8	7	0.7	4.4	8.9	5.9	0.9173	Very good
45509	51300	0	5	9	5	0.7	4.2	8.4	5.6	0.9512	" "
45702	51400	1	7	9	6	0.9	5.1	10.2	6.8	0.9695	" "
46006	51500	2	3	10	7	0.8	4.9	9.8	6.5	2.5146	0.6654
44306	51700	1	8	10	5	0.9	5.3	10.7	7.1	2.0193	0.5689
44311	51800	1	3	9	7	0.7	4.4	8.9	5.9	0.7562	Very good
44503	51900	3	4	12	7	1.0	5.8	11.6	7.7	4.9379	0.1731
44609	52000	0	5	10	10	0.9	5.6	11.1	7.4	2.0001	0.5724
44614	52100	0	3	7	5	0.6	5.3	6.7	4.4	0.6751	Very good
44711	52200	0	8	13	9	1.1	6.7	13.4	8.9	1.3873	0.7126
44807	52300	0	6	11	6	0.9	5.1	10.2	6.6	1.1631	0.7639
44905	52400	0	3	3	3	0.3	2.0	4.0	2.7	1.1233	0.7730
40701	52500	1	8	14	9	1.2	7.1	14.2	9.5	0.1680	Very good
40702	52600	1	2	14	10	1.0	6.0	12.0	8.0	3.4999	0.3262
40703	52700	0	3	7	5	0.6	3.3	6.7	4.4	0.6751	Very good
40705	52800	2	1	5	5	0.5	2.9	5.8	3.9	6.4720	0.0932
40708	52900	0	3	11	6	0.7	4.4	8.9	5.9	1.7125	0.6582
40709	53000	0	7	8	6	0.8	4.7	9.3	6.2	2.2715	0.5233
40710	53100	0	2	9	4	0.6	3.3	6.7	4.4	1.9501	0.5839
40802	53200	1	6	6	4	0.6	3.8	7.6	5.0	2.4708	0.4917
40803	53300	1	5	10	8	0.9	5.3	10.7	7.1	0.2847	Very good
40901	53500	0	2	6	5	0.5	2.9	5.8	3.9	1.1057	0.7771

TABLE V-b (continued)

F ₂ 1924 Selec- tion No.	F ₃ 1925 plat No.	Actual No. of ears with ratios of				Theoretical No. (1:6:12:8) of ears with ratios of				X ²	Closeness of Fit (P)
		1:0	3:1	9:7	27:37	1:0	3:1	9:7	27:37		
40902	53600	0	1	7	6	0.5	3.1	6.2	4.1	2.8699	0.4152
41001	53700	1	1	8	1	0.4	2.4	4.9	3.3	5.2613	0.1562
41002	53800	1	3	8	5	0.6	3.8	7.6	5.0	0.9766	Very good
41213	54800	1	5	9	3	0.7	4.0	8.0	5.3	1.5624	0.6724
41312	55100	1	3	9	5	0.7	4.0	8.0	5.3	0.5625	Very good
41313	55200	1	4	11	5	0.8	4.7	9.3	6.2	0.6964	" "
41401	55300	1	6	8	5	0.7	4.4	8.9	5.9	0.8679	" "
41504	55700	1	5	10	6	0.8	4.9	9.8	6.5	0.1138	" "
41507	55800	1	5	7	6	0.7	4.2	8.4	5.6	0.5396	" "
41706	56400	0	4	3	3	0.4	2.2	4.4	3.0	1.8129	0.6154
41816	56800	0	4	7	4	0.5	3.3	6.7	4.4	0.7498	Very good
41902	56900	1	4	9	5	0.7	4.2	8.4	5.6	0.2435	" "
41905	57100	2	4	6	4	0.6	3.6	7.1	4.7	3.7151	0.2986
42002	57200	1	2	6	5	0.6	3.1	6.2	4.1	1.0268	0.7952
42401	57500	0	2	10	3	0.6	3.3	6.7	4.4	3.2248	0.3624
42501	57600	1	3	8	6	0.7	4.0	8.0	5.3	0.5000	Very good
42516	57800	1	3	9	5	0.7	4.0	8.0	5.3	0.5625	" "
42602	57900	0	1	8	1	0.4	2.2	4.4	2.9	5.1883	0.1605
42701	58000	1	4	5	5	0.6	3.5	6.7	4.4	0.9749	Very good
42802	58200	0	4	9	6	0.7	4.2	8.4	5.6	0.7764	Very good
42906	58300	1	3	11	3	0.7	4.0	8.0	5.3	2.5623	0.4708

TABLE V-b (continued)

F ₂ 1924 Selec- tion No.	F ₃ 1925 plat No.	Actual No. of				Theoretical				x ²	Close- ness of fit (P)
		ears with ratios of				No. (1:6:12:8) of ears with ratios of					
		1:3	3:1	9:7	27:37	1:0	3:1	9:7	27:37		
43004	58400	1	9	8	3	0.8	4.7	9.3	6.2	5.9461	0.1150
43603	58500	0	4	3	2	0.3	2.0	3.9	2.7	2.6335	0.4218
43803	58600	1	10	15	4	1.1	6.7	13.3	8.9	4.5769	0.2098
43916	58700	0	4	11	6	0.8	4.7	9.3	6.2	1.1785	0.7572
44001	58800	0	4	14	7	0.9	5.6	11.1	7.4	1.7550	0.6286
44004	58900	1	5	9	8	0.9	5.1	10.2	6.8	0.3571	Very good
44101	59000	0	4	7	6	0.6	3.8	7.6	5.0	1.2348	0.7476
44104	59100	1	5	5	4	0.6	3.3	6.7	4.4	1.6494	0.6528
44207	59200	1	6	8	5	0.7	4.4	8.9	5.9	0.7871	Very good
Total	52 plats	35	221	448	276	36.3	217.8	435.6	290.4	1.1607	0.7645

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As seen in Table V-b, of a total of 980 ears from 52 plats, 53 were 1:0 ratio, 221 were 3:1 ratio, 448 were 9:7 ratio, and 276 were 27:37 ratio for colored to colorless seeds. Their expected numbers on a basis of 1:6:12:8 ratio were 36.5:217.6:435.6:290.4. The value of χ^2 is 1.1607 and hence the value of closeness of fit (P) is 0.7645. This indicates that these observations are very close to expectancy.

Here the 3:1 ears were of three sorts genotypically. Colorless individuals (kernels) of the 3:1 ears derived from the F_2 genotype $AaCCRR$ were the A-tester types which were sought for by the present experiment. Likewise, the colorless kernels from the 3:1 ears of the F_2 genotype $AACcRR$ would produce a C-tester type, $AaCcRR$, and the colorless kernels of the 3:1 ears of the F_2 genotype $AACCRr$ would produce an R-tester type, $AACCRr$. How to sort the A-tester type out of the other two types will be described later on.

Segregation of yellow and white endosperm characters

As pointed out previously, all the mother strains had the yellow endosperm character and were crossed with Emerson's A-tester which had the white endosperm character. On the basis of a single pair of factors, the former should be YY and the latter yy regardless of the aleurone factors. All the F_1 kernels should be yellow due to the factor Y being dominant over its allelomorph y, and they should segregate in the manner of 2 yellow to 1 white in F_2 when self-pollinated. It should be recalled that the yellow endosperm was wholly covered up in the F_1 and partly so in the F_2 by the colored

The first of these is the fact that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The second is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The third is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The fourth is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The fifth is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The sixth is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The seventh is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The eighth is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The ninth is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable. The tenth is that the system is not a simple one. It is a complex system, and the behavior of the system is not predictable.

aleurones. No data were taken for these two generations.

Three groups of ears segregating for the yellow and white endosperms were observed in the colorless aleurone individuals of the 3:1 F_3 classes. These groups were those which bred true for either yellow or white endosperm and those which did not breed true for the yellow endosperm but segregated in a 3:1 ratio. The results are arranged in Table VI.

Forty F_3 ears with a total of 3370 yellow kernels were found to be in the group (a in Table VI) which bred true for the yellow endosperm character, since the progenies of these ears resulted in a total of 233 ears with only the yellow endosperm in the F_4 generation.

Thirty-five F_3 ears with a total of 2866 white seeds were noted and found to be in the group (c in Table VI) which bred true for the white endosperm but were not carried on to the F_4 .

Eighty-two F_3 ears were found to be in the group (b in Table VI) which did not breed true for either of these characters. They gave a total of 4870 yellow seeds to 1567 white seeds, where 4827.75; 1069.25 were expected. A deviation of 42.25 was obtained, which is 1.8 times its probable error. Evidently it is a 3:1 ratio of yellows to whites on these ears. The yellow individuals were carried on to the F_4 generation and resulted in 141 yellow seeded ears (1:0) and 298 yellow and white seeded ears in nearly a proportion of 1:2. Calculating on this basis the expected numbers for these two classes of ears are 146.3 : 292.7. The deviation is 5.3 which is only 0.8 times its probable error. Thus, observations are very close to expectancy.

TABLE VI. Segregation of yellow and white endosperm in the colorless aleurone individuals of the 3:1 F_3 class and their behavior in F_4 .

(a) Group which bred true for the yellow endosperm.

1925 (F_3) Selection No.	Number of Kernels with endosperm		1926 (F_4) Plant No.	Number of ears		
	-Yellow-	-White-		Yellow seeded	Yellow and white seeded	White seeded
51707	90	0	650300	3	0	0
52603	72	0	650600	1	0	0
52803	30	0	650900	1	0	0
53006	75	0	651200	8	0	0
53302	105	0	651600	6	0	0
53303	40	0	651700	1	0	0
53801	83	0	652300	11	0	0
53915	92	0	652700	11	0	0
54006	86	0	653000	14	0	0
54116	72	0	653500	5	0	0
54208	14	0	653900	0	0	0
54304	90	0	654000	15	0	0
54404	80	0	654300	5	0	0
54509	68	0	654600	0	0	0
54605	101	0	654800	5	0	0
54608	106	0	654900	5	0	0
54708	92	0	655000	9	0	0
54906	134	0	655200	11	0	0
55102	98	0	655900	1	0	0
55202	90	0	656100	8	0	0
55303	70	0	656500	9	0	0

TABLE VI, (a) (continued)

1925 (F ₃) Selection No.	Number of kernels with endosperm		1926 (F ₄) Plot No.	Number of ears		
	-Yellow-	-White-		Yellow seeded	Yellow and white seeded	White Seeded
55307	146	0	656600	16	0	0
55510	75	0	657100	3	0	0
55804	84	0	657700	7	0	0
55903	89	0	657800	3	0	0
55909	40	0	658000	4	0	0
56007	110	0	658100	7	0	0
56303	39	0	658300	4	0	0
56403	109	0	658500	1	0	0
57501	105	0	659500	3	0	0
57603	76	0	659700	2	0	0
57901	121	0	660000	3	0	0
58303	95	0	660700	5	0	0
58501	62	0	661100	9	0	0
58502	123	0	661200	15	0	0
58602	117	0	661300	6	0	0
58603	95	0	661400	3	0	0
58606	58	0	661500	4	0	0
58607	70	0	661600	2	0	0
58702	62	0	661800	7	0	0
Total 40 ears	3370	0		233	0	0

TABLE VI (continued)

(b) Group segregating for the yellow and white endosperms.

1925 (F ₃) Selection No.	Number of kernels with endosperm		1926 (F ₄) Plat No.	Number of ears		
	-Yellow-	-White-		Yellow seeded	Yellow and White seeded	White seeded
51204	63	21	650000	2	6	0
51503	81	30	650100	1	3	0
51704	72	20	650200	0	1	0
52301	55	25	650400	0	3	0
52504	65	21	650500	0	3	0
52702	50	21	650700	1	4	0
52703	18	6	650800	0	1	0
52902	42	21	651000	0	1	0
53002	65	21	651100	1	2	0
53202	77	25	651300	3	5	0
53205	47	14	651400	2	4	0
53207	15	4	651500	failed		
53304	52	22	651800	2	6	0
53404	51	19	651900	3	0	0
53405	78	22	652000	1	2	0
53502	29	12	652100	0	4	0
53601	66	25	652200	0	2	0
53908	91	28	652400	5	10	0
53910	94	34	652500	6	11	0
53911	90	28	652600	0	5	0
53917	89	28	652800	1	4	0
53918	83	22	652900	4	5	0

TABLE VI, (b) (continued)

1925 (F ₃) Selection No.	Number of kernels with endosperm		1926 (F ₄) Plat No.	Number of ears		
	-Yellow-	-White-		Yellow seeded	Yellow and white seeded	White seeded
54009	62	16	653100	2	3	0
54103	42	14	653200	self-pollination failed		
54107	100	27	653300	2	6	0
54112	20	7	653400	1	2	0
54118	52	15	653600	1	2	0
54205	63	20	653700	failed		
54207	11	5	653800	0	1	0
54308	36	14	654100	2	4	0
54310	38	14	654200	3	1	0
54405	65	17	654400	3	4	0
54408	82	24	654500	8	3	0
54604	59	19	654700	3	4	0
54905	63	23	655100	0	2	0
54908	43	17	655300	3	4	0
55004	55	20	655400	2	4	0
55005	58	20	655500	2	3	0
55007	62	20	655600	2	4	0
55008	61	17	655700	0	0	0
55010	57	21	655800	0	0	0
55103	92	31	656000	4	9	0
55203	37	13	656200	0	2	0
55204	42	14	656300	1	5	0

ANNUAL REPORT 2019

The 2019 Annual Report of the European Central Bank (ECB) provides an overview of the ECB's activities and the results of its work. The report is structured into four main parts: the ECB's role and mandate, the ECB's work in 2019, the ECB's financial position, and the ECB's governance. The report also includes a section on the ECB's communication and a section on the ECB's external relations.

Area	Activity	Frequency	Frequency	Frequency	Frequency
Monetary Policy	ECB Governing Council meetings	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Press conferences	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Monetary Policy Trimestly Reports	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Monetary Policy Statements	Quarterly	Quarterly	Quarterly	Quarterly
Financial Stability	ECB Financial Stability Reports	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Financial Stability Review	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Financial Stability Bulletin	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Financial Stability News	Quarterly	Quarterly	Quarterly	Quarterly
Banking Supervision	ECB Banking Supervision Reports	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Banking Supervision Review	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Banking Supervision Bulletin	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Banking Supervision News	Quarterly	Quarterly	Quarterly	Quarterly
Communication	ECB Communication Reports	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Communication Review	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Communication Bulletin	Quarterly	Quarterly	Quarterly	Quarterly
	ECB Communication News	Quarterly	Quarterly	Quarterly	Quarterly
External Relations	ECB External Relations Reports	Quarterly	Quarterly	Quarterly	Quarterly
	ECB External Relations Review	Quarterly	Quarterly	Quarterly	Quarterly
	ECB External Relations Bulletin	Quarterly	Quarterly	Quarterly	Quarterly
	ECB External Relations News	Quarterly	Quarterly	Quarterly	Quarterly

TABLE VI, (b) (continued)

1925 (F ₃) Selection No.	Number of kernels <u>with endosperm</u>		1926 (F ₄) Plot No.	Number of ears		
	-Yellow-	-White-		Yellow seeded	Yellow and white seeded	White seeded
55205	98	30	656400	5	11	0
55411	62	18	656700	2	3	0
55502	50	22	656800	1	3	0
55508	65	28	656900	2	4	0
55509	71	22	657000	3	10	0
55511	62	14	657200	2	4	0
55603	52	18	657300	1	5	0
55703	86	28	657400	0	4	0
55802	78	21	657500	2	8	0
55803	90	26	657600	2	6	0
55904	83	24	657900	2	3	0
56202	60	18	658200	3	4	0
56401	88	25	658400	2	1	0
56503	66	13	658600	2	6	0
56801	88	22	658700	0	3	0
56802	59	24	658800	1	3	0
56804	34	10	658900	0	2	0
56902	49	11	659000	3	9	0
56903	46	12	659100	3	7	0
57003	50	14	659200	1	3	0
57104	hard to classify		659300	1	2	0
57203	35	16	659400	2	0	0

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TABLE VI, (b) (continued)

1925 (F ₃) Selection No.	Number of kernels with endosperm		1926 (F ₄) plat No.	Number of ears		
	-Yellow-	-White-		Yellow seeded	Yellow and white seeded	White seeded
57602	55	24	659600	1	2	0
57703	68	20	659800	3	3	0
57802	62	22	659900	2	2	0
58004	44	15	660100	2	4	0
58103	70	24	660200	2	5	0
58107	64	19	660300	3	4	0
58108	89	26	660400	5	8	0
58202	36	13	660500	2	4	0
58204	36	19	660600	0	2	0
58402	77	25	660800	2	5	0
58403	50	15	660900	0	0	0
58404	83	15	661000	1	2	0
58701	39	8	661700	2	3	0
58704	90	25	661900	2	4	0
59205	62	24	662000	1	1	0
59206	<u>hard to classify</u>		662100	<u>2</u>	<u>3</u>	<u>0</u>
Total for 82 ears -- 4870			Total for 82 plats-- 141	298 0		
Expected total -- 4827.75			Expected total -- 146.3	292.7		
Deviation total -- + 42.25			Deviation total -- - 5.3	+ 5.3		
$\frac{\text{Dev.}}{\text{P.E.}} = \frac{42.25}{23.4} = 1.8$			$\frac{\text{Dev.}}{\text{P.E.}} = \frac{5.3}{6.7} = 0.8$			

TABLE VI (continued)

(c) Group which bred true for the white endosperm but not carried on to F_4 .

1925 (F_3) Selection No.	Number of kernels with endosperm		1925 (F_3) Selection No.	Number of kernels with endosperm	
	-Yellow-	-White-		-Yellow-	-White-
52701	0	138	56204	0	66
53306	0	85	56307	0	95
53804	0	83	56402	0	118
54007	0	120	56506	0	51
54008	0	62	56608	0	89
54108	0	58	56703	0	91
54110	0	73	56905	0	68
54117	0	92	57402	0	103
54306	0	92	58002	0	69
54505	0	123	58201	0	102
54512	0	68	58405	0	78
54610	0	31	58406	0	56
54704	0	122	58407	0	94
54803	0	50	58503	<u>0</u>	<u>114</u>
54805	0	50	Total 35 ears	0	2866
55009	0	41			
55407	0	88			
55602	0	99			
56006	0	76			
56106	0	71			
56203	0	50			

Figure 1. The effect of the number of trials on the number of correct responses. The number of correct responses was plotted against the number of trials for each condition. The number of correct responses was significantly higher for the 10 trials condition than for the 5 trials condition. The number of correct responses was significantly higher for the 10 trials condition than for the 5 trials condition. The number of correct responses was significantly higher for the 10 trials condition than for the 5 trials condition.

TESTING THE F_3 FOR STRAINS OF A-TESTER YELLOW DENT CORN

Two methods have been followed in sorting out the A-tester type from the other two types, C-tester and R-tester. One method was to detect the anthocyanic pigment of seedlings grown from the colorless seeds of 3:1 F_3 ears. The other method was to cross these three tester types with Emerson's A, C, and R aleurone color testers.

Results of the seedling test

It was thought that the A factor was entirely responsible for the production of anthocyanic pigment in the mature corn plant and likewise in the seedlings. Consequently, the types C-tester and R-tester could be eliminated at the seedling stage, since they had the A factor which would cause those seedlings to be colored, whereas the A-tester type could be picked out because its seedlings would be non-colored on account of lacking the A factor. This idea was proved to be invalid, to some extent, by the results of the other method, i.e. crossing these tester types with Emerson's aleurone testers in the field (see Tables IX-a and IX-b). Those results have revealed that both the A-tester type and the C-tester type resulted from colorless seeds of 3:1 F_3 ears of the 27:37 F_2 group, whose seedlings were considered to be non-colored by the seedling test (Table IX-b), and that the seedling test could not be used to rogue out the C-tester type from the A-tester type.

By a later experiment (pages 67-99), it has been found that

the multiple allelomorphic factor r^R of the R series was present in the R-tester type, hence the type was $AACCr^Rr^R$; r^R causes the seedlings to be colored in presence of the A factor. Also, $R^G R^G$ recessive to $r^R r^R$ for plant color, has been found present in the A-tester type, hence the type was $aaCCR^G R^G$ and in the C-tester type making it $AaCoR^G R^G$. In the presence of the factor A, $R^G R^G$ would cause these seedlings to be non-colored. This is the reason why the C-tester type could not be rogued out by the seedling test, but it could be distinguished by crossing it with Emerson's testers.

In the winter of 1925, colorless seeds from 394 3:1 F_3 ears were planted in sand trays in the laboratory for seedling tests. Of the 394 ears, 208 were progenies of the 9:7 F_2 ears and 186 were progenies of the 27:37 F_2 ears. About three weeks after planting, the seedlings were pulled out and their color was recorded. From the 9:7 F_2 lot, of 208 ears, 99 showed colored seedlings and 109 gave non-colored seedlings. The results are shown in Table VII-a. As pointed out previously, there were two kinds of 3:1 F_3 ears, genotypically, i.e. one contained the A-tester type and the other contained the R-tester type. Theoretically, these two types should have been in equal numbers and approximately such was the case. Thus the 109 ears must have been of the A-tester type and the 99 ears of the R-tester type. They were practically in equal proportion. The expected numbers were 104:104. This exhibits a deviation of 5, which is only 1.0 times its probable error. Observations were very close to expectation. That this conclusion was correct was

TABLE VII-a. Showing that colorless seeds of 99 3:1 F_3 ears of the 9:7 F_2 group gave only colored seedlings, which would be of the R-tester (ACr) type; and that colorless seeds of 109 3:1 F_3 ears of the same F_2 group gave only non-colored seedlings which would be of the A-tester (aCR) type.

1925 (F_3) Plat No.	Number of 3:1 F_3 ears giving		1925 (F_3) Plat No.	Number of 3:1 F_3 ears giving	
	colored seedlings (ACr)	non-colored seedlings (aCR)		colored seedlings (ACr)	non-colored seedlings (aCR)
51600	3	0	56200	1	4
53400	1	2	56300	3	3
53900	11	6	56500	2	3
54000	2	5	56600	4	2
54100	8	8	56700	1	1
54200	6	0	57000	1	3
54300	4	6	57100	1	2
54400	2	4	57200	1	1
54500	7	6	57300	1	4
54600	2	3	57400	1	2
54700	3	3	57700	2	2
54900	5	4	58100	2	4
55000	3	4	58300	<u>2</u>	<u>1</u>
55400	4	5	Actual		
55500	3	8	total -	99	109
55600	1	3	Expected		
55900	4	5	total -	104	104
56000	4	3	Deviation-	-5	45
56100	4	2			
			Dev. =	$\frac{5.0}{4.8}$	= 1.04
			P.E.		

proved by the results from the field crosses between these two tester types and Emerson's testers. As shown in Tables VIII-a, VIII-c and IX-a, the colorless kernels of 3:1 F_3 ears, whose seedlings were shown to be non-colored by the seedling test, produced only the A-tester type, and those whose seedlings were shown to be colored by the same test produced only the R-tester type.

From the 27:37 F_2 lot, of 186 F_3 ears, 63 gave colored seedlings and 123 gave non-colored ones. The results are shown in Table VII-b. As said before, the 3:1 ears were of three sorts in this group, namely, the A-tester type ($aaCCR^E R^E$), the C-tester type ($AAccR^E R^E$) and the R-tester type ($AAcCr^F r^F$). Obviously, these 63 ears must have been the R-tester type, while the 123 ears must have been the A-tester type plus the C-tester type. Calculation on 1:2 basis showed that the expected numbers for the R-tester type and for the A-tester type plus the C-tester type were 62:124. The deviation is 1.0, which is only 0.2 times its probable error. Observation accords with expectancy exceedingly well. This conclusion was also verified by the results from the actual field crosses between these tester types and Emerson's testers, as is shown in Tables VIII-a, VIII-b, VIII-c and IX-b, because both the A-tester type and the C-tester type resulted from the colorless seeds of 3:1 F_3 ears whose seedlings were shown to be non-colored by the seedling test, and the R-tester type resulted from the colorless seeds of 3:1 F_3 ears whose seedlings were shown to be colored by the same test.

TABLE VII-b. Colorless seeds of 63 3:1 F_3 ears of the 27:37 F_2 group produced only colored seedlings, which would be of the R-tester type (ΔCr); and those of 123 3:1 F_3 ears of the same F_2 group produced only non-colored seedlings, which would be of the Δ -tester type plus the C-tester type.

1925 (F_3) Plat No.	Number of 3:1 F_3 ears giving		1925 (F_3) Plat No.	Number of 3:1 F_3 ears giving	
	colored seedlings (ΔCr)	non-colored seedlings ($aCR + \Delta CR$)		colored seedlings (ΔCr)	non-colored seedlings ($aCR + \Delta CR$)
51200	1	4	53200	2	4
51300	3	2	53300	1	4
51400	3	4	53500	1	1
51500	1	2	53600	0	1
51700	2	5	53700	0	0
51800	1	2	53800	0	3
51900	3	0	54800	1	3
52000	1	2	55100	2	1
52100	0	1	55200	1	3
52200	1	4	55300	1	5
52300	2	1	55700	1	3
52400	1	1	55800	1	3
52500	6	2	56400	0	3
52600	0	2	56800	1	3
52700	0	3	56900	1	3
52800	0	1	57100	1	2
52900	2	1	57500	0	1
53000	2	4	57600	0	2
53100	1	0	57800	1	1

TABLE VII-b (continued)

1925 (F ₃) Plat No.	Number of 3:1 F ₃ ears giving	
	colored seedlings (ACr)	non-colored seedlings (aCR + AcR)
57900	0	1
58000	2	2
58200	1	3
58300	2	1
58400	2	6
58500	2	2
58600	2	6
58700	1	3
58800	2	2
58900	1	3
59000	1	2
59100	0	2
59200	<u>2</u>	<u>3</u>
Actual total -	63	123
Expected total (1:2) -	62	124
Deviation	+1	-1
 $\frac{\text{Dev.}}{\text{P.E.}} = \frac{1.0}{4.2} = 0.2$		

QUESTION 1

1. The following table shows the number of people who attended the 2010 World Cup in South Africa, by country and by gender. The data is presented in a 2x2x2 contingency table.

Country	Gender	Number of people	
		Male	Female
England	Male	100	50
	Female	50	100
France	Male	150	75
	Female	75	150
Germany	Male	200	100
	Female	100	200
Italy	Male	120	60
	Female	60	120
Spain	Male	180	90
	Female	90	180
United States	Male	140	70
	Female	70	140
Total	Male	780	390
	Female	390	780

2. The following table shows the number of people who attended the 2010 World Cup in South Africa, by country and by gender. The data is presented in a 2x2x2 contingency table.

Results of crosses between F_3 A-, C-, and R-tester types and Emerson's A-, C-, and R-testers.

Out of 394 3:1 F_3 ears in the seedling test, 190 were selected for the 1926 planting. From such ears only seeds with yellow endosperm were planted in the field. Of the 190 ears, 110 whose cobs were white and whose seedlings were non-colored were planted in 110 plats on one side of the field; while 13 red-cobbed ears with colored seedlings were planted in 13 plats, 25 red-cobbed ears with non-colored seedlings were planted in 25 plats, and 42 white-cobbed ears with colored seedlings were planted in 42 plats on the other side of the field. The purpose of this planting was two-fold: (1) to identify the A-tester type by crossing with Emerson's testers, and (2) to determine any relation between the color of seedlings and these three tester types, especially the A-tester type. The center rows in the field were planted with Emerson's A-, C-, and R-testers. In each of the 190 plats, 4 or more plants were crossed with the A-tester, 4 with the C-tester and 4 with the R-tester. Several of the remaining plants in the plat were selfed. The principle for these crosses is shown in the following diagram:

Emerson's Aleurone color testers

Tester types from 3:1 F_3 ears	A-tester	C-tester	R-tester
	aCR	AcR	ACr
aCR	Colorless	Colored	Colored
AcR	Colored	Colorless	Colored
ACr	Colored	Colored	Colorless

In this way, the A-, C-, and R-tester types from the yellow seeds of these 3:1 F₃ ears could be determined and distinguished.

There were 92 plats in which the plants or ears proved to be the A-tester types because in these plats 171 hybrid ears were colorless when crossed with the Emerson A-tester, 214 were colored when crossed with the C-tester, and 178 were colored when crossed with the R-tester. The results are arranged in Table VIII-a and illustrated in Plate I. Some of the selfed ears in these plats are the strains of A-tester Yellow Dent sought for in this problem. A detail for selection of these strains will be given under another heading.

Table VIII-b shows that plants or ears of 31 plats proved to be the C-tester types since they gave 55 colored hybrid ears when crossed with A-testers, 49 colorless ears when crossed with C-testers, and 49 partially colored and all colored ears when crossed with R-testers. The types are illustrated in Plate II. The latter hybrid ears should be all colored according to theory, as indicated in the diagram. The partially colored ears were probably caused by some of the R-testers, being heterozygous for the C factor.

Fifty-five plats were found to have plants of the R-tester type as shown by the fact that the plants gave 86 colored ears when crossed with A-testers, 71 colored ears when crossed with C-testers and 73 colorless ears when crossed with R-testers. The data are indicated in Table VIII-c and types illustrated in Plate III.

There were 12 plats in which both crosses and selfings failed. They are noted in parenthesis () in Tables IX-a and IX-b. Some of

TABLE VIII-a. Showing results of crossing the A-tester types (aGR) with Emerson's A-, C-, R-testers.

Name of Variety	Accession No.	F ₁ 1923 selection No.	F ₂ 1924 selection No.	F ₃ 1925 selection No.	1926 Plat No.	Color of F ₃ seedlings	No. of ears colorless when crossed with A-tester	No. of ears colored when crossed with C-,	No. of ears colored when crossed with R-tester
Red Cobbed Duncan	234	31802	44807	52301	650400	w	1	2	2
White Cobbed Duncan	235	301150	40701	52504	650500	w	failed 0	4	failed 0
			40703	52702	650700	w	2	2	2
			40709	53006	651200	w	3	3	3
		301151	40802	53202	651300	w	3	4	3
				53205	651400	w	1	2	2
			40803	53302	651600	w	3	1	3
			40807	53404	651900	w	2	2	1
				53405	652000	w	1	1	2
White Cobbed M.A.C.	254	30331	41102	53908	652400	w	3	4	3
				53910	652500	w	2	4	3
				53911	652600	w	2	2	1
				53915	652700	w	3	4	2
				53918	652900	w	1	1	2
			41109	54006	653000	w	4	4	3
				54009	653100	w	1	3	1
			41113	54103	653300	w	4	5	2
				54112	653400	w	2	2	1

w = non-colored (green)

TABLE VIII-a. (continued)

Name of Variety	Accession No.	F ₁ 1923 selection No.	F ₂ 1924 selection No.	F ₃ 1925 selection No.	1926 Plat no.	Color of F ₃ seed- lings	No. of color- less ears when crossed with A-tester	No. of colored ears when crossed with C-, R-tester	
White Cobbed M.A.C.	254			54116	653500	w	2	3 2	
				54118	653600	w	3	1 3	
			41118	54304	654000	w	3	4 2	
				54308	654100	w	3	3 2	
				54310	654200	w	2	0 2	
			41119	54404	654300	w	2	2 3	
				54405	654400	w	2	3 3	
				54408	654500	w	1	2 3	
			30332	41211	54605	654800	w	2	2 1
					54608	654900	w	2	0 0
			41212	54708	655000	w	3	2 1	
			41216	54905	655100	w	3	2 1	
				54906	655200	w	3	2 3	
				54908	655300	w	1	2 2	
		30333	41311	55005	655500	w	2	0 1	
				55007	655600	w	0	3 3	
			41312	55103	656000	w	2	3 3	
				55105	656400	w	3	3 3	
		30408	41401	55303	656500	w	2	4 3	
				55307	656600	w	3	3 3	
			41409	55411	656700	w	2	2 2	

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TABLE VIII-a (continued)

Name of Variety	Accession No.	F ₁ 1923 selection No.	F ₂ 1924 selection No.	F ₃ 1925 selection No.	1926 Plat No.	Color of F ₃ seed- lings	No. of color- less ears when crossed with A-tester	No. of colored ears when crossed with C-, R-tester
White Cobbed M.A.C.	254		41413	55502	656800	w	1	2 1
				55508	656900	w	1	3 1
				55509	657000	w	3	2 2
				55510	657100	w	2	2 1
				55511	657200	w	2	4 3
	30409		41503	55603	657300	w	1	2 2
			41504	55703	657400	w	2	4 1
			41507	55802	657500	w	1	2 2
				55803	657600	w	3	4 2
			41512	55903	657800	w	2	3 2
	30513			55904	657900	w	2	2 3
				55909	658000	w	2	2 1
			41602	56007	658100	w	2	3 3
			41605	56202	658200	w	2	2 3
			41701	56303	658300	w	2	1 0
	30514		41708	56503	658600	w	3	2 3
			41816	56801	658700	w	2	2 2
				56802	658800	w	1	3 3
	30604		41902	56902	659000	w	1	1 4
				56903	659100	w	1	3 2
			41904	57003	659200	w	2	3 2

QUESTIONNAIRE

1. Name of the respondent: _____

2. Address: _____

3. Telephone: _____

4. E-mail: _____

5. Date of birth: _____

6. Sex: _____

7. Marital status: _____

8. Number of children: _____

9. Number of siblings: _____

10. Number of pets: _____

11. Number of cars: _____

12. Number of boats: _____

13. Number of motorcycles: _____

14. Number of bicycles: _____

15. Number of televisions: _____

16. Number of refrigerators: _____

17. Number of washing machines: _____

18. Number of air conditioners: _____

19. Number of computers: _____

20. Number of mobile phones: _____

21. Number of internet connections: _____

22. Number of social media accounts: _____

23. Number of email accounts: _____

24. Number of bank accounts: _____

25. Number of credit cards: _____

26. Number of insurance policies: _____

27. Number of investments: _____

28. Number of real estate properties: _____

29. Number of vehicles: _____

30. Number of other assets: _____

31. Number of other assets: _____

32. Number of other assets: _____

33. Number of other assets: _____

34. Number of other assets: _____

35. Number of other assets: _____

36. Number of other assets: _____

37. Number of other assets: _____

38. Number of other assets: _____

39. Number of other assets: _____

40. Number of other assets: _____

41. Number of other assets: _____

42. Number of other assets: _____

43. Number of other assets: _____

44. Number of other assets: _____

45. Number of other assets: _____

46. Number of other assets: _____

47. Number of other assets: _____

48. Number of other assets: _____

49. Number of other assets: _____

50. Number of other assets: _____

51. Number of other assets: _____

52. Number of other assets: _____

53. Number of other assets: _____

TABLE VIII-a (continued)

Name of Variety	Accession No.	F ₁ 1923 selection No.	F ₂ 1924 selection No.	F ₃ 1925 selection No.	1926 Plat No.	Color of F ₃ seedlings	No. of colorless ears when crossed with A-tester	No. of colored ears when crossed with C-, R-tester
White Cobbed MAC	254		41905	57104	659300	w	0	2 1
		30904	42401	57501	659500	w	2	0 2
		31008	42501	57602	659600	w	2	3 1
			42505	57703	659800	w	2	4 1
			42516	57802	659900	w	1	2 3
		31009	42602	57901	660000	w	0	2 3
		31011	42701	58004	660100	w	3	3 3
			42706	58103	660200	w	2	2 4
				58107	660300	w	2	3 2
				58108	660400	w	3	3 2
		31111	42802	58202	660500	w	1	3 0
		31112	42906	58303	660700	w	2	2 1
		31113	43004	58403	660900	w	1	1 2
				58404	661000	w	1	1 1
		31306	43603	58501	661100	w	2	6 2
				58502	661200	w	1	2 2
		31308	43803	58602	661300	w	1	3 3
				58603	661400	w	2	2 3
				58606	661500	w	2	4 3
				58607	661600	w	2	2 0
		31309	43916	58702	661800	w	0	3 3



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TABLE VIII-a (continued)

Name of Variety	Accession No.	F ₁ 1923 selection No.	F ₂ 1924 selection No.	F ₃ 1925 selection No.	1926 Plat No.	Color of F ₃ seed- lings	No. of color- less ears when crossed with A-tester	No. of colored ears when crossed with C-, R-tester			

Nelson X Bailey	255	31432	44207	59205	662000	w	2	1	2		
				59206	662100	w	3	3	2		
Bailey	128	32201	45502	51201	663500	w	1	1	1		
				32301	45702	51402	663900	w	1	1	1
						51403	664000	w	1	2	1
				32407	46006	51502	664300	w	0	1	1
White Cobbed Duncan	235	30806	42203	57303	665500	w	2	0	0		
					57305	665600	w	2	0	0	
					42208	57403	665700	w	2	1	0
Red Cobbed Duncan	234	31803	44807	52302	666400	w	1	2	1		
White Cobbed M.A.C.	254	30331	41118	54312	667900	w	<u>2</u>	<u>1</u>	<u>2</u>		
TOTAL				92	plats		171	⁴ 214	178		

PLATE I



Individuals in plat 652400 proved to be the A-tester type (aCR) of corn since they produced three colorless ears (top of the picture) when crossed with Emerson's A-tester, three colored ears (on left side at bottom) when crossed with C-tester and two colored ears (on right side at bottom) when crossed with R-tester.

1. The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation $f(x) = \int_0^x f(t) dt$. It is shown that $f(x)$ is a continuous function and that it satisfies the differential equation $f'(x) = f(x)$. The solution of this equation is $f(x) = Ce^x$, where C is a constant. The value of C is determined by the initial condition $f(0) = 1$, which gives $C = 1$. Therefore, the function $f(x)$ is $f(x) = e^x$.

TABLE VIII-b. Showing results of crossing the C-tester types (AcR) with Emerson's A-, C-, and R- testers.

Name of Variety	Access- ion No.	F ₁ 1923 selec- tion No.	F ₂ 1924 selec- tion No.	F ₃ 1925 selec- tion No.	1926 Plat No.	Color of F ₃ seed- lings	Number of ears		
							colored when crossed with A-tester	colorless when crossed with C-tester	colored when crossed with R-tester
Bailey	128	32201	45502	51204	650000	w	2	3	3*
White Cob. Duncan	235	301150	40703	52703	650800	w	1	1	0
			40702	52603	650600	w	2	1	1*
			40705	52803	650900	w	2	2	3*
			40709	53002	651100	w	2	5	3*
			301151	40803	53303	651700	w	2	2
				53304	651800	w	2	2	3*
White Cob. M.A.C.	254	30255	40901	53502	652100	w	1	1	2*
			40902	53601	652200	w	3	2	2*
		30256	41002	53803	652300	w	4	5	1 + 2*
		30333	41313	55202	656100	w	5	2	1*
		30409	41507	55804	657700	w	1	4	2*
		30514	41706	56401	658400	w	2	2	3*
				56403	658500	w	3	0	3*
		30515	41816	56804	658900	w	2	2	1*
		31008	42501	57603	659700	w	0	2	1*
		31111	42802	58204	660600	w	0	1	0
Bailey	128	32201	45502	58701	661700	w	2	1	2
				58704	661900	w	3	3	1*
				51202	663600	w	1	0	0
				51205	663700	w	2	1	2*
				45509	51319	663800	w	1	1
	32301	45702	51405	664100	w	1	2	1	
				51406	664200	w	1	1	0

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• **What is the purpose of the study?** The purpose of the study is to determine the effect of the use of a mobile phone on the performance of a simulated driving task.

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TABLE VIII-b (continued)

Name of Variety	Accession No.	F ₁ 1923	F ₂ 1924	F ₂ 1925	1926 Plat No.	Color of F ₃ seed- lings	Number of ears		
		selec- tion No.	selec- tion No.	selec- tion No.			colored when crossed with A-tester	colorless when crossed with C-tester	colored when crossed with R-tester
Red Cob. Duncan	234	31604	44306	51701	664400	w	2	0	2*
				51801	664500	w	0	0	1
			44311	51802	664600	w	1	0	0
		31704	44609	52003	664800	w	1	0	1*
		31802	44711	52201	665100	w	1	1	0
		31430	44104	59102	665900	w	2	1	3*
		31432	44207	59204	666000	w	<u>3</u>	<u>1</u>	<u>1*</u>
TOTAL.					31 plats . . .	55	49	48	

* Ears were partly colored.

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PLATE II



The picture shows that individuals in plat 652300 proved to be the C-tester type (AcR), since they gave three colorless ears (center of the picture) when crossed with Emerson's C-tester (AcR), three colored ears (on left-hand side) when crossed with A-tester and two partly colored ears (on right-hand side) when crossed with R-tester. The partial coloring was probably due to heterozygous (Cc) in R-tester.

TABLE VIII-c. Results of crossing the R-tester types (ACr) with Emerson's A-, C-, and R-testers.

Name of Variety	Maternal Accession No.	F ₁ 1923 selection No.	F ₂ 1924 selection No.	F ₃ 1925 selection No.	1926 Plat No.	Color of F ₃ seedlings	Number of ears			
							colored when crossed with A-, C- tester	colorless when crossed with R-tester		
Bailey	128	32408	46006	51503	650100	R	1	2	1	
Red Cobbed Duncan	234	31604	44306	51704	650200	R	3	1	0	
				51707	650300	R	3	3	2	
White Cob. Duncan	235	301150	40708	52902	651000	R	1	1	1	
White Cob. M.A.C.	254	30331	41102	53917	652800	R	2	2	4	
			41113	54103	653200	R	1	2	1	
			54208	653900	R	1	1	0		
			30332	41211	54604	654700	R	2	3	1
			30333	41311	55004	655400	R	2	2	2
			55008	655700	R	0	1	0		
			55010	655800	R	2	1	2		
			41313	55203	656200	R	3	3	3	
			55204	656300	R	2	2	3		
			31306	43603	58402	660800	R	2	3	2
Bailey	128	32201	45502	51203	662200	R	3	2	2	
			45509	51315	662300	R	2	1	1	
			51317	662400	R	1	0	0		
			32301	45702	51404	662500	R	2	1	1
			51413	662600	R	1	3	3		
Red Cobbed Duncan	234	31604	44304	51601	662700	R	2	2	1	

R = colored

1. The first part of the report is a general introduction to the project.

2. The second part of the report is a detailed description of the methodology used in the study.

3. The third part of the report is a discussion of the results of the study.

4. The fourth part of the report is a conclusion and recommendations for future research.

5. The fifth part of the report is a list of references.

6. The sixth part of the report is a list of appendices.

7. The seventh part of the report is a list of figures.

8. The eighth part of the report is a list of tables.

9. The ninth part of the report is a list of abbreviations.

10. The tenth part of the report is a list of symbols.

11. The eleventh part of the report is a list of acronyms.

12. The twelfth part of the report is a list of footnotes.

13. The thirteenth part of the report is a list of endnotes.

14. The fourteenth part of the report is a list of references.

15. The fifteenth part of the report is a list of appendices.

16. The sixteenth part of the report is a list of figures.

17. The seventeenth part of the report is a list of tables.

18. The eighteenth part of the report is a list of abbreviations.

19. The nineteenth part of the report is a list of symbols.

20. The twentieth part of the report is a list of acronyms.

TABLE VIII-c (continued)

Name of Variety	Maternal Accession No.	F ₁ 1923 selection No.	F ₂ 1924 selection No.	F ₃ 1925 selection No.	1926 Plat No.	Color of F ₃ seedlings	Number of ears		
							colored when crossed with A-, C-tester	colorless when crossed with R-tester	
			44303	51602	662800	R	2	1	1
				51603	662900	R	2	1	1
			44306	51703	663000	R	2	2	1
		31703	44503	51904	663100	R	2	1	2
				51905	663200	R	1	0	2
		31803	44807	52303	663300	R	1	1	1
White Cobbed M.A.C.	254	30806	42203	57306	663400	R	2	1	0
Red Cobbed Duncan	234	31802	44711	52205	665300	R	1	1	2
Bailey	128	32201	45502	51316	666100	R	1	2	1
Red Cobbed Duncan	234	31604	44306	51702	666200	R	1	1	1
		31704	44609	52001	666300	R	3	1	0
White Cobbed Duncan	235	301150	40701	52507	666500	R	2	1	2
				52510	666600	R	0	0	2
			40710	53101	666800	R	1	0	2
		301151	40803	53305	667000	R	1	2	2
			40807	53403	667100	R	1	0	2
White Cobbed M.A.C.	254	30331	41102	53904	667200	R	1	1	0
				53905	667300	R	2	1	2
				53906	667400	R	2	1	2
				53913	667500	R	2	1	2
			41109	54005	667600	R	2	1	1
			41113	54111	667700	R	1	2	2

1. Introduction

The purpose of this report is to provide a comprehensive overview of the current state of research in the field of artificial intelligence (AI) and its applications. This report will discuss the various sub-fields of AI, including machine learning, natural language processing, and computer vision, and will explore the challenges and opportunities associated with these technologies.

1.1	Machine Learning	Machine learning is a subset of AI that focuses on the development of algorithms that can learn from data and make predictions or decisions based on that learning. It is a key component of many AI applications, including recommendation systems, fraud detection, and image recognition.	Machine learning is a subset of AI that focuses on the development of algorithms that can learn from data and make predictions or decisions based on that learning. It is a key component of many AI applications, including recommendation systems, fraud detection, and image recognition.
1.2	Natural Language Processing	Natural language processing (NLP) is a sub-field of AI that focuses on the interaction between computers and human language. It involves the development of algorithms that can understand, interpret, and generate human language.	Natural language processing (NLP) is a sub-field of AI that focuses on the interaction between computers and human language. It involves the development of algorithms that can understand, interpret, and generate human language.
1.3	Computer Vision	Computer vision is a sub-field of AI that focuses on the development of algorithms that can enable computers to "see" and understand the visual world. This involves the development of algorithms that can process and analyze images and videos.	Computer vision is a sub-field of AI that focuses on the development of algorithms that can enable computers to "see" and understand the visual world. This involves the development of algorithms that can process and analyze images and videos.
1.4	Robotics	Robotics is a sub-field of AI that focuses on the development of algorithms that can enable robots to perform tasks in the real world. This involves the development of algorithms that can control the movement and actions of robots.	Robotics is a sub-field of AI that focuses on the development of algorithms that can enable robots to perform tasks in the real world. This involves the development of algorithms that can control the movement and actions of robots.
1.5	AI Ethics	AI ethics is a sub-field of AI that focuses on the ethical implications of AI and its applications. It involves the development of guidelines and principles that can ensure that AI is used in a responsible and ethical manner.	AI ethics is a sub-field of AI that focuses on the ethical implications of AI and its applications. It involves the development of guidelines and principles that can ensure that AI is used in a responsible and ethical manner.
1.6	AI in Healthcare	AI in healthcare is a sub-field of AI that focuses on the application of AI to the field of medicine. This involves the development of algorithms that can assist in the diagnosis and treatment of diseases.	AI in healthcare is a sub-field of AI that focuses on the application of AI to the field of medicine. This involves the development of algorithms that can assist in the diagnosis and treatment of diseases.
1.7	AI in Finance	AI in finance is a sub-field of AI that focuses on the application of AI to the field of finance. This involves the development of algorithms that can assist in the analysis of financial data and the making of investment decisions.	AI in finance is a sub-field of AI that focuses on the application of AI to the field of finance. This involves the development of algorithms that can assist in the analysis of financial data and the making of investment decisions.
1.8	AI in Education	AI in education is a sub-field of AI that focuses on the application of AI to the field of education. This involves the development of algorithms that can assist in the delivery of personalized education and the assessment of student performance.	AI in education is a sub-field of AI that focuses on the application of AI to the field of education. This involves the development of algorithms that can assist in the delivery of personalized education and the assessment of student performance.
1.9	AI in Transportation	AI in transportation is a sub-field of AI that focuses on the application of AI to the field of transportation. This involves the development of algorithms that can assist in the management of traffic and the development of autonomous vehicles.	AI in transportation is a sub-field of AI that focuses on the application of AI to the field of transportation. This involves the development of algorithms that can assist in the management of traffic and the development of autonomous vehicles.
1.10	AI in Manufacturing	AI in manufacturing is a sub-field of AI that focuses on the application of AI to the field of manufacturing. This involves the development of algorithms that can assist in the optimization of manufacturing processes and the development of intelligent manufacturing systems.	AI in manufacturing is a sub-field of AI that focuses on the application of AI to the field of manufacturing. This involves the development of algorithms that can assist in the optimization of manufacturing processes and the development of intelligent manufacturing systems.
1.11	AI in Agriculture	AI in agriculture is a sub-field of AI that focuses on the application of AI to the field of agriculture. This involves the development of algorithms that can assist in the management of crops and the development of intelligent farming systems.	AI in agriculture is a sub-field of AI that focuses on the application of AI to the field of agriculture. This involves the development of algorithms that can assist in the management of crops and the development of intelligent farming systems.
1.12	AI in Space Exploration	AI in space exploration is a sub-field of AI that focuses on the application of AI to the field of space exploration. This involves the development of algorithms that can assist in the management of spacecraft and the development of intelligent space exploration systems.	AI in space exploration is a sub-field of AI that focuses on the application of AI to the field of space exploration. This involves the development of algorithms that can assist in the management of spacecraft and the development of intelligent space exploration systems.
1.13	AI in Environmental Science	AI in environmental science is a sub-field of AI that focuses on the application of AI to the field of environmental science. This involves the development of algorithms that can assist in the analysis of environmental data and the development of intelligent environmental management systems.	AI in environmental science is a sub-field of AI that focuses on the application of AI to the field of environmental science. This involves the development of algorithms that can assist in the analysis of environmental data and the development of intelligent environmental management systems.
1.14	AI in Social Media	AI in social media is a sub-field of AI that focuses on the application of AI to the field of social media. This involves the development of algorithms that can assist in the analysis of social media data and the development of intelligent social media management systems.	AI in social media is a sub-field of AI that focuses on the application of AI to the field of social media. This involves the development of algorithms that can assist in the analysis of social media data and the development of intelligent social media management systems.
1.15	AI in Marketing	AI in marketing is a sub-field of AI that focuses on the application of AI to the field of marketing. This involves the development of algorithms that can assist in the analysis of marketing data and the development of intelligent marketing strategies.	AI in marketing is a sub-field of AI that focuses on the application of AI to the field of marketing. This involves the development of algorithms that can assist in the analysis of marketing data and the development of intelligent marketing strategies.
1.16	AI in Customer Service	AI in customer service is a sub-field of AI that focuses on the application of AI to the field of customer service. This involves the development of algorithms that can assist in the delivery of personalized customer service and the development of intelligent customer service systems.	AI in customer service is a sub-field of AI that focuses on the application of AI to the field of customer service. This involves the development of algorithms that can assist in the delivery of personalized customer service and the development of intelligent customer service systems.
1.17	AI in Human Resources	AI in human resources is a sub-field of AI that focuses on the application of AI to the field of human resources. This involves the development of algorithms that can assist in the recruitment and management of employees.	AI in human resources is a sub-field of AI that focuses on the application of AI to the field of human resources. This involves the development of algorithms that can assist in the recruitment and management of employees.
1.18	AI in Law	AI in law is a sub-field of AI that focuses on the application of AI to the field of law. This involves the development of algorithms that can assist in the analysis of legal data and the development of intelligent legal systems.	AI in law is a sub-field of AI that focuses on the application of AI to the field of law. This involves the development of algorithms that can assist in the analysis of legal data and the development of intelligent legal systems.
1.19	AI in Politics	AI in politics is a sub-field of AI that focuses on the application of AI to the field of politics. This involves the development of algorithms that can assist in the analysis of political data and the development of intelligent political systems.	AI in politics is a sub-field of AI that focuses on the application of AI to the field of politics. This involves the development of algorithms that can assist in the analysis of political data and the development of intelligent political systems.
1.20	AI in History	AI in history is a sub-field of AI that focuses on the application of AI to the field of history. This involves the development of algorithms that can assist in the analysis of historical data and the development of intelligent historical systems.	AI in history is a sub-field of AI that focuses on the application of AI to the field of history. This involves the development of algorithms that can assist in the analysis of historical data and the development of intelligent historical systems.
1.21	AI in Art	AI in art is a sub-field of AI that focuses on the application of AI to the field of art. This involves the development of algorithms that can assist in the creation of art and the development of intelligent art systems.	AI in art is a sub-field of AI that focuses on the application of AI to the field of art. This involves the development of algorithms that can assist in the creation of art and the development of intelligent art systems.
1.22	AI in Music	AI in music is a sub-field of AI that focuses on the application of AI to the field of music. This involves the development of algorithms that can assist in the creation of music and the development of intelligent music systems.	AI in music is a sub-field of AI that focuses on the application of AI to the field of music. This involves the development of algorithms that can assist in the creation of music and the development of intelligent music systems.
1.23	AI in Film	AI in film is a sub-field of AI that focuses on the application of AI to the field of film. This involves the development of algorithms that can assist in the creation of film and the development of intelligent film systems.	AI in film is a sub-field of AI that focuses on the application of AI to the field of film. This involves the development of algorithms that can assist in the creation of film and the development of intelligent film systems.
1.24	AI in Video Games	AI in video games is a sub-field of AI that focuses on the application of AI to the field of video games. This involves the development of algorithms that can assist in the creation of video games and the development of intelligent video game systems.	AI in video games is a sub-field of AI that focuses on the application of AI to the field of video games. This involves the development of algorithms that can assist in the creation of video games and the development of intelligent video game systems.
1.25	AI in Sports	AI in sports is a sub-field of AI that focuses on the application of AI to the field of sports. This involves the development of algorithms that can assist in the analysis of sports data and the development of intelligent sports systems.	AI in sports is a sub-field of AI that focuses on the application of AI to the field of sports. This involves the development of algorithms that can assist in the analysis of sports data and the development of intelligent sports systems.
1.26	AI in Entertainment	AI in entertainment is a sub-field of AI that focuses on the application of AI to the field of entertainment. This involves the development of algorithms that can assist in the creation of entertainment and the development of intelligent entertainment systems.	AI in entertainment is a sub-field of AI that focuses on the application of AI to the field of entertainment. This involves the development of algorithms that can assist in the creation of entertainment and the development of intelligent entertainment systems.
1.27	AI in Science	AI in science is a sub-field of AI that focuses on the application of AI to the field of science. This involves the development of algorithms that can assist in the analysis of scientific data and the development of intelligent scientific systems.	AI in science is a sub-field of AI that focuses on the application of AI to the field of science. This involves the development of algorithms that can assist in the analysis of scientific data and the development of intelligent scientific systems.
1.28	AI in Technology	AI in technology is a sub-field of AI that focuses on the application of AI to the field of technology. This involves the development of algorithms that can assist in the development of technology and the development of intelligent technology systems.	AI in technology is a sub-field of AI that focuses on the application of AI to the field of technology. This involves the development of algorithms that can assist in the development of technology and the development of intelligent technology systems.
1.29	AI in Business	AI in business is a sub-field of AI that focuses on the application of AI to the field of business. This involves the development of algorithms that can assist in the management of business and the development of intelligent business systems.	AI in business is a sub-field of AI that focuses on the application of AI to the field of business. This involves the development of algorithms that can assist in the management of business and the development of intelligent business systems.
1.30	AI in Society	AI in society is a sub-field of AI that focuses on the application of AI to the field of society. This involves the development of algorithms that can assist in the analysis of social data and the development of intelligent social systems.	AI in society is a sub-field of AI that focuses on the application of AI to the field of society. This involves the development of algorithms that can assist in the analysis of social data and the development of intelligent social systems.

TABLE VIII-c (continued)

Name of Variety	Maternal Accession No.	F ₁ 1923 selection No.	F ₂ 1924 selection No.	F ₃ 1925 selection No.	1926 Plat No.	Color of F ₃ seedlings	colored when crossed with A-, C-tester		colorless when crossed with R-tester
			41114	54204	667800	R	1	1	2
				54205	653700	R	0	1	0
			41119	54406	668000	R	2	2	1
		30332	41201	54504	668100	R	1	1	1
		30333	41212	54704	668200	R	1	1	1
			41312	55104	668300	R	1	0	0
		30408	41409	55412	668400	R	0	0	1
		30515	41802	56604	668500	R	2	1	2
		30806	42203	57404	665800	R	3	0	0
		31111	42906	58302	668600	R	2	2	1
		31306	43603	58504	668700	R	2	2	1
Nelson X Bailey	255	31430	44004	58905	668800	R	1	1	1
		31432	44207	59202	668900	R	<u>1</u>	<u>1</u>	<u>1</u>
TOTAL					55 plats		86	71	73

PLATE III



Individuals in this plat proved to be the R-tester type (ACr) as they produced two colorless ears (right) when crossed with R-tester, three colored ears (center) when crossed with C-tester and two colored ears (left) when crossed with A-tester.

them were determined as A-, or R-tester types by their seedling color.

Glancing at Tables IX-a and IX-b, one will see that there is perfect correlation between the R-tester type and the color of seedlings. In other words, those whose seedlings were colored were the R-tester types. Likewise, the A-tester types were correlated with non-colored seedlings, but they could not be distinguished by seedling color from the C-tester types whose seedlings were also non-colored, when both types came from the 27:37 F_2 group (see Table IX-b). Thus it is seen that these data give a substantial support to the seedling test.

DESCRIPTION AND SELECTION OF STRAINS OF A-TESTER YELLOW DENT CORN

In 92 plats a total of 371 selfed ears proving to be the A-tester types was obtained in the F_4 generation (1926). Among these, some ears were yellow dent and some were yellow flint. In regard to the endosperm color, some ears were homozygous for the yellow endosperm and some were segregating for the yellow and white endosperms (see Table VI). The flint and the white endosperm characters came from Emerson's A-tester, while the dent and the yellow endosperm characters came from the maternal strains used in this experiment.

Out of the 371 ears, 36 with homozygous yellow endosperm in dent form were considered as desirable ears. The pedigrees of these ears are given in Table X. From the 36 ears, 11 were selected as

TABLE IX-a. Showing that the seedling color of colorless individuals of 3:1 F_3 ears coming from the 9:7 F_2 group were verified by crossing with Emerson's testers. The A-tester type resulted from those individuals having non-colored seedlings and the R-tester type from those having colored seedlings.

1925 (F_3) selection No.	F_3 seedling color	1926 (F_4) Plat No.	Tester type proved to be-	1925 (F_3) selection No.	F_3 seedling color	1926 (F_4) Plat No.	Tester type proved to be-
51601	R	662700	ACr	54112	W	653400	aCR
51602	R	662800	"	54116	W	653500	"
51603	R	662900	"	54118	W	653600	"
53403	R	667100	"	54204	R	667800	ACr
53404	W	651900	aCR	54205	R	653700	(")
53405	W	652000	"	54207	R	653800	(")
53904	R	667200	ACr	54208	R	653900	"
53905	R	667300	"	54304	W	654000	aCR
53906	R	667400	"	54308	W	654100	"
53908	W	652400	aCR	54310	W	654200	"
53910	W	652500	"	54312	W	667900	"
53911	W	652600	"	54404	W	654300	"
53913	R	667500	ACr	54405	W	654400	"
53915	W	652700	aCR	54406	R	668000	ACr
53917	R	652800	ACr	54408	W	654500	aCR
53918	W	652900	aCR	54504	R	668100	ACr
54005	R	667600	ACr	54509	W	654600	(aCR)
54006	W	653000	aCR	54604	R	654700	ACr
54009	W	653100	"	54605	W	654800	aCR
54103	R	653200	ACr	54608	W	654900	"
54107	W	653300	aCR	54704	R	668200	ACr
54111	R	667700	ACr	54708	"	655000	aCR

R = colored; W = non-colored

TABLE IX-a (continued)

1925 (F ₃) Selec- tion No.	F ₃ seed- ling color	1926 (F ₄) Plat No.	Tester type proved to be-	1925 (F ₃) Selec- tion No.	(F ₃) <u>Color of</u> Seed- ling	1926 (F ₄) Plat No.	Tester type proved to be-
54905	W	655100	aCR	56604	H	668500	ACr
54906	W	655200	"	57003	W	659200	aCR
54908	W	655300	"	57203	W	659400	(")
55004	R	655400	ACr	57303	W	665500	"
55005	W	655500	aCR	57305	W	665600	"
55007	W	655600	"	57306	R	663400	ACr
55008	R	655700	ACr	57403	W	665700	aCR
55010	R	655800	"	57404	R	665800	ACr
55411	W	656700	aCR	57703	W	659800	aCR
55412	R	668400	ACr	58103	W	660200	"
55502	W	656800	aCR	58107	W	660300	"
55508	W	656900	"	58108	W	660400	"
55509	W	657000	"				
55510	W	657100	"				
55511	W	657200	"				
55603	W	657300	"				
55903	W	657800	"				
55904	W	657900	"				
55909	W	658000	"				
56007	W	658100	"				
56202	W	658200	"				
56303	W	658300	"				
56503	W	658600	"				

() crosses in these plats failed,
so types were determined by seedling
color.

THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. It begins with the first settlers, who came to the Americas in search of a new life. They found a land of opportunity, but also a land of challenge. The early years were marked by conflict and struggle, as the settlers fought to establish a new society. Over time, the United States grew from a small colony into a powerful nation. It has faced many challenges, but it has always emerged stronger and more united than before.

Year	Event	Significance	Impact
1492	Columbus discovers America	First European contact with the Americas	Beginning of European colonization
1607	First English settlement in Jamestown	Establishment of a permanent English colony	Start of English presence in North America
1776	Declaration of Independence	United States becomes an independent nation	Birth of the United States
1789	Constitution signed	Establishment of the federal government	Foundation of the modern United States
1861-1865	Civil War	Conflict over slavery and states' rights	Abolition of slavery and preservation of the Union
1898	Spanish-American War	United States becomes a world power	Acquisition of territories like Puerto Rico and the Philippines
1901	Antitrust legislation	Regulation of big business	Protection of consumers and fair competition
1914	Progressive Era	Reform movements across the country	Improvements in labor rights and social welfare
1929	Stock market crash	Beginning of the Great Depression	Widespread economic hardship
1933	New Deal	Franklin D. Roosevelt's response to the Depression	Government intervention in the economy
1941	Pearl Harbor attack	United States enters World War II	Global conflict and eventual victory
1945	End of World War II	Victory over the Axis powers	Establishment of the United Nations
1950s	Cold War	Tension between the US and the Soviet Union	Space race and nuclear arms race
1960s	Civil Rights Movement	Fighting for equality and justice	Legislation like the Civil Rights Act
1970s	Vietnam War	Conflict in Southeast Asia	Social unrest and anti-war protests
1980s	Reagan Revolution	Conservative resurgence	Reduction in government spending
1990s	Clinton Presidency	End of the Cold War	Globalization and technological advancement
2001	9/11 attacks	Terrorist attacks on the World Trade Center	War on Terror and increased security
2008	Financial crisis	Global economic downturn	Stimulus packages and bailouts
2016	Trump Presidency	Unconventional election victory	Policy shifts in trade and immigration
2020	COVID-19 pandemic	Global health crisis	Lockdowns and economic challenges

TABLE IX-b. Showing that the seedling color of the colorless individuals of 3:1 F_3 ears coming from the 27:37 F_2 group were verified by crossing with Emerson's A-, C-, and R-testers. The R-tester type was correlated with colored seedlings; both A-, and C-tester types resulted from those having non-colored seedlings.

1925 (F_3) Selection No.	F_3 seed- ling color	1926 (F_4) Plat No.	Tester type proved to be-	1925 (F_3) Selection No.	F_3 seed- ling color	1926 (F_4) Plat No.	Tester type proved to be-
51201	W	663500	aCR	51707	R	650300	ACr
51202	W	663600	AcR	51801	W	664500	AcR
51203	R	662200	ACr	51802	W	664600	"
51204	W	650000	AcR	51904	R	663100	ACr
51205	W	663700	"	51905	R	663200	"
51315	R	662300	ACr	52001	R	666300	"
51316	R	666100	"	52002	W	664700	(--)
51317	R	662400	"	52003	W	664800	AcR
51319	W	663800	AcR	52101	W	664900	(--)
51402	W	663900	aCR	52201	W	665000	(--)
51403	W	664000	"	52202	W	665100	AcR
51404	R	662500	ACr	52204	W	665200	(--)
51405	W	664100	AcR	52205	R	665300	ACr
51406	W	664200	"	52301	W	650400	aCR
51413	R	662600	ACr	52302	W	666400	"
51502	W	664300	aCR	52303	R	663300	ACr
51503	R	650100	ACr	52401	W	665400	(--)
51701	W	664400	AcR	52504	W	650500	aCR
51702	R	666200	ACr	52507	R	666500	ACr
51703	R	663000	"	52510	R	666600	"
51704	R	650200	"	52603	W	650600	AcR

R = colored; W = non-colored

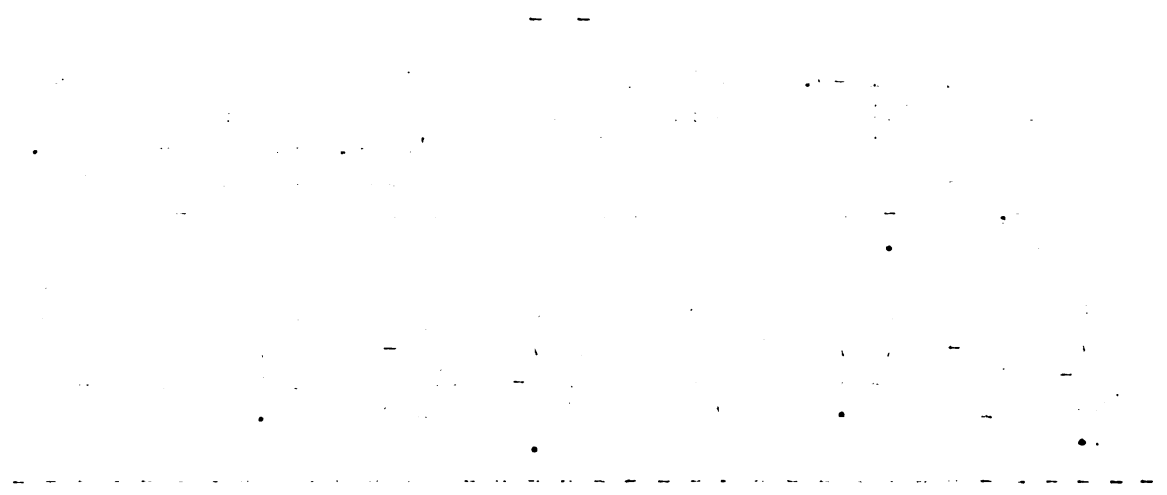


TABLE IX-b (continued)

1925 (F ₃) Selec- tion No.	F ₃ seed- ling color	1926 (F ₄) Plat No.	Tester type proved to be-	1925 (F ₃) Selec- tion No.	F ₃ seed- ling color	1926 (F ₄) Plat No.	Tester type proved to be-
52702	W	650700	aCR	55203	R	656200	ACr
52703	W	650800	ACr	55204	R	656300	"
52803	W	650900	"	55205	W	656400	aCR
52902	R	651000	ACr	55303	W	656500	"
53002	W	651100	ACr	55307	W	656600	"
53003	R	666700	(ACr)	55703	W	657400	aCR
53006	W	651200	aCR	55802	W	657500	"
53101	R	666800	ACr	55803	W	657600	aCR
53202	W	651300	aCR	55804	W	657700	ACr
53204	R	666900	(ACr)	56401	W	658400	"
53205	W	651400	aCR	56403	W	658500	"
53207	W	651500	(--)	56801	W	658700	acR
53302	W	651600	aCR	56802	W	658800	"
53303	W	651700	ACr	56804	W	658900	AcR
53304	W	651800	"	56902	W	659000	acR
53305	R	667000	ACr	56903	W	659100	"
53502	W	652100	ACr	57104	W	659300	"
53601	W	652200	"	57501	W	659500	"
53803	W	652300	"	57602	W	659600	"
55102	R	655900	(ACr)	57603	W	659700	ACr
55103	W	656000	aCR	57802	W	659900	aCR
55104	R	668300	ACr	57901	W	660000	"
55202	W	656100	ACr	58004	W	660100	"

TABLE IX-b (continued)

1925 (F ₃) Sele- tion No.	F ₃ seed- ling color	1926 (F ₄) Plat No.	Tester type proved to be-		
58202	W	660500	aCR	52002	These individuals could not be classified as the A-, or C-tester type by seedling color.
58204	W	660600	AcR	52101	
58303	W	660700	aCR	52204	
58302	R	668600	ACr	52401	
58402	R	660800	"	53207	
58403	W	660900	aCR	52201	
58404	W	661000	"		were of the ACr type as determined by their colored seedlings as crosses failed in the field.
58501	W	661100	"	(ACr) 52003 53204	
58502	W	661200	aCR	55102	
58504	R	668700	ACr		
58602	W	661300	aCR		
58603	W	661400	"		
58606	W	661500	"		
58607	W	661600	"		
58701	W	661700	AcR		
58702	W	661800	aCR		
58704	W	661900	AcR		
58905	R	668800	ACr		
59102	W	665900	AcR		
59202	R	668900	ACr		
59204	W	666000	AcR		
59205	W	662000	aCR		
59206	W	662100	"		

(--) crosses in these plats failed.

the most desirable types and are shown in Table X with (*) marks and in Plate IV. This table shows that one of the 36 ears is the descendant of White Cobbed Duncan, ^{and} 35 are descendants of White Cobbed Golden Glow X White Cobbed Duncan,

Ears numbered 656510 and 656511 are the A-tester yellow dent with white caps, and hence are called the "White Capped A-Tester Yellow Dent". They are sisters as both came from a mother ear (No. 55303) of the F_3 generation.

As to some ear characters, all of the 36 ears are white cobbled with yellow endosperm in the dent form; the number of kernel rows ranges from 10 to 14; the length of ear ranges from 10 to 19 centimeters; the weight of ear is from 34 to 125 grams; and the indentation of all ears is smooth.

The growth, as observed in the field in 1926, of A-, C-, and R-tester types was fairly good, although they were hit by a sand storm and several frosts during the seedling stage. The soil was very poor because of lack of manure and fertilizers, but plants of the A-tester type in most plats looked more uniform and vigorous than those of their sister types, C-, and R-testers in the same breeding lot (see the Table on page 66). This gives at least an indication that the lack of anthocyanic pigment in the A-tester types has no bad effect upon the plant growth and the yield. It was thought that the A-tester types, lacking the factor for anthocyanin, would grow weaker and not give as good a yield as

TABLE X. Showing parentages and general characters of 36 strains of A-tester Yellow Dent.

Name of Variety	Accession No.	P ₁ 1922 selec- tion	F ₁ 1923 selec- tion	F ₂ 1924 selec- tion	F ₃ 1925 selec- tion	F ₄ 1926 selec- tion	Cob Color	Length of ear in cms.	No. of rows	Wt. of ear in grams	Color of endo-sperm	Indenta- tion
Wh. Cob. Duncan	235	02600	301150	40803	53302	651608	White	13	12	68	Yellow	Smooth
Wh. Cob. G. Glow X	254	<u>02600</u> 12904	30331		53908	652411*	"	15	14	97	deep yellow	"
						652412	"	14	14	97	yellow	"
Wh. Cob. Duncan				41102	53910	652510	"	13	14	86	"	"
					53918	652905	"	12	14	69	"	"
						653012*	"	17	12	110	"	"
						653013*	"	15	14	101	"	"
				41109	54006	653014	"	15	14	85	"	"
						653015	"	14	14	86	"	"
						653016	"	17	12	100	"	"
				41113	54103	653312	"	19	14	88	"	"
						654010*	"	14	14	95	"	"
						654011*	"	13	12	77	"	"
						654012	"	13	12	75	"	"
				41118	54304	654013	"	12	12	70	"	"
						654014	"	12	12	63	"	"
						654015	"	12	12	60	"	"
		25202	30408	41211	54606	654806	"	10	12	64	"	"
						654807	"	12	14	65	"	"
					55303	656510*	"	16	12	106	Wh. cap. yellow	"
				41401		656511*	"	13	12	96	"	"

TABLE X (continued)

Name of Access- Variety	ion No.	P ₁ 1922 selec- tion No.	F ₁ 1923 selec- tion No.	F ₂ 1924 selec- tion No.	F ₃ 1925 selec- tion No.	F ₄ 1926 selec- tion No.	Cob Length Color of ear in cms.	No. of rows	Wt. of ear in grams	Color of endo- sperm	Indenta- tion
					55307	656610	White	15	12	108	wh.cap. Smooth
				41409	55411	656707	"	10	14	45	Yellow Yellow "
	25206	31008	42416	57802	659907*	"	14	12	90	"	"
					659908*	"	16	12	93	"	"
		31009	42602	57901	660006	"	--	--	--	"	"
			42701	58004	660110	"	--	--	--	"	"
		31011	42708	58103	660209	"	13	12	68	faded yellow	"
					660210	"	12	14	74	yellow & dilute yellow	"
				58107	660308	"	17	14	126	yellow	"
					660309	"	11	14	34	"	"
	25207	31111	42802	58202	660505	"	17	10	89	"	"
	25313	31306	43603	58501	551112	"	16	12	91	"	"
				58502	661205	"	12	14	75	"	"
		31309	43916	58702	661807*	"	13	14	109	deep yellow	"
					661808*	"	12	12	95	"	"

(*) The most desirable strains.



PLATE IV



Strains of A-tester Yellow Dent Corn.

Nos. 656510 and 656511 (on right side of the picture) are
the White Capped A-tester Yellow Dent.

the C-tester and R-tester types, which have the A factor. In order to put this discussion on a scientific basis, a statistical study of plant height, ear length, and ear weight for these three tester types, A-, C-, and R-, was made.

Twenty-five plants were measured for height if the plat had 25 or more plants, and all plants were measured if the plat had less than 25 plants. All selfed ears were measured for length of ear, and weight of ear. Biometric constants were calculated.

A comparison of height of plants was made between the A-tester type and the R-tester type. The difference was slightly in favor of the A-tester type, but it was not significant statistically. Comparisons of ear length and ear weight between these two types indicate that the differences are also in favor of the A-tester type, but of not statistical significance. Similarly, these three variables have been compared between the A-tester type and the C-tester type. All differences were in favor of the A-tester type. The data for these comparisons are given below:

Type	Height of plant		Length of Ear		Weight of Ear	
	Mean $\pm$ E	C.V.	Mean $\pm$ E	C.V.	Mean $\pm$ E	C.V.
	Feet	Percent	Cms.	Percent	Grams	Percent
A-tester	4.98 $\pm$ 0.38	11.56	13.41 $\pm$ 1.13	12.83	64.09 $\pm$ 9.54	22.20
R-tester	4.96 $\pm$ 0.37	11.33	12.83 $\pm$ 1.12	13.43	52.22 $\pm$ 9.20	28.32
Dif.---	+0.02 $\pm$ 0.53	+0.23	+0.58 $\pm$ 1.56	-0.60	+12.87 $\pm$ 13.23	-6.12
A-tester	4.98 $\pm$ 0.38	11.56	13.41 $\pm$ 1.13	12.83	64.09 $\pm$ 9.54	22.20
C-tester	4.98 $\pm$ 0.47	14.66	12.04 $\pm$ 1.18	14.70	51.61 $\pm$ 10.02	29.27
Dif.---	0.00 $\pm$ 0.64	-3.10	+1.37 $\pm$ 1.14	-1.87	+12.48 $\pm$ 13.79	-7.07

Summing up the above, it is concluded that the A-tester type of corn is not inferior to the other types, C-, and R-testers, in growth and yield, in terms of plant height, ear length, and ear weight.

RELATION OF THE FACTORS R^S AND r^r TO THE DEVELOPMENT
OF ANTHOCYANIC PIGMENT AS FOUND IN THIS EXPERIMENT

Emerson (1921) has pointed out that the R factor exists as a series of allelomorphs, such as, R^r , R^S , r^r , r^S , etc. The factor r^r is recessive for aleurone color and dominant for plant color, while the factor R^S is dominant for aleurone color and recessive for plant color. R^rR^r or R^rR^S or r^rR^r or r^rR^S will cause more or less red pigment to develop in the plant body in the presence of the A factor. Neither R^SR^S nor r^Sr^S will cause red pigment to develop in the plant body in presence of A, which is the factor responsible for the production of any anthocyanic pigment in a corn plant.

It has been mentioned in a previous section that the A-, and C-tester types, progenies of the 27:37 F_2 group, which could not be separated by the seedling test, might involve the factor R^SR^S , and that the R-tester types, which were easily rogued out by seedling tests, must involve the factor r^rR^r . It is upon this fact and upon this assumption that the following investigation has been taken up.

Seedling color in the P_1 and F_1 generations

Remnants of 16 maternal P_1 strains were obtained and planted in sand trays. Twelve of them gave only colored seedlings, and the remaining 4 strains gave mostly colored seedlings with but very few non-colored ones. This indicates that the strains whose seedlings were pigmented must have carried the factor r^r which causes the seedlings to be colored in the presence of the A factor. Their compositions

— *Chlorophyll a* (mg g⁻¹ dry weight) = 12.72 (OD₆₈₀)^{0.78} (Eq. 1)

TABLE XI-a. Showing that all maternal P_1 strains gave colored seedlings, indicating the presence of r^+r^+ .

Name of Variety	Accession No.	1922 Selection No. or Plat No.	1923 Plat No.	Number of seedlings	
				Colored	Non-colored
White Cob.		<u>02600</u>			
G. Glow X		12901	30200	22	0
White Cob.	254	<u>02600</u>			
Duncan		12904	30300	39	4
		25202	30400	19	0
		25203	30500	22	0
		25303	30600	16	0
		25306	30700	21	0
		25312	30800	22	0
		25205	30900	22	0
		25206	31000	35	0
		25207	31100	34	2
		25302	31200	38	0
Nelson X	255	23000	31400	16	0
Bailey					
Red Cobbed	234	23400	31600	15	5
Duncan		23701	31800	25	14
		23802	31900	5	0
Bailey	128	24301	32300	20	3
TOTAL				371	28

TABLE XI-b. The paternal parent, A-tester gave all non-colored seedlings. These were later proved to be $R^S R^S$.

Ear No.-	Colored seedlings-	Colorless seedlings-
1	0	24
2	0	22
3	0	24
4	0	25
TOTAL	0	95

• The first step in the process of creating a new product is to identify a market need. This involves conducting market research to determine what consumers want and what problems they are trying to solve.

Once a market need has been identified, the next step is to develop a concept for a product that meets that need. This involves brainstorming ideas and selecting the most promising one. The concept should be based on a clear understanding of the target market and the competitive landscape.

After developing a concept, the next step is to create a prototype. This is a physical model of the product that allows you to test its functionality and appearance. Prototyping is an important part of the product development process because it allows you to identify and address any issues before moving forward with full-scale production.

Once a prototype has been created, the next step is to conduct a feasibility study.

This study involves assessing the technical, financial, and market viability of the product.

It is important to conduct a feasibility study before investing significant resources in the product development process.

Once a feasibility study has been completed, the next step is to develop a business plan.

This plan outlines the financial and operational aspects of the business, including the marketing strategy and the production process.

It is important to have a solid business plan in place before seeking funding or launching the product.

Once a business plan has been developed, the next step is to secure funding.

This can be done through a variety of methods, including crowdfunding, venture capital, and bank loans.

Once funding has been secured, the next step is to begin production. This involves setting up a manufacturing process and ensuring that the product is produced to the highest quality standards. It is important to monitor the production process closely to identify and address any issues as they arise.

Once production has begun, the next step is to launch the product.

This involves creating a marketing campaign and promoting the product to the target market.

It is important to have a solid marketing strategy in place before launching the product to ensure that it reaches the right audience and generates the desired level of interest.

Once the product has been launched, the next step is to monitor its performance.

This involves tracking sales, customer feedback, and other key metrics to determine how well the product is performing in the market.

It is important to regularly monitor the performance of the product to identify any areas for improvement and to make adjustments as needed.

Once the product has been successfully launched and its performance is being monitored, the next step is to consider future product development.

This involves identifying new market needs and developing concepts for new products that address those needs.

It is important to continue to innovate and develop new products to stay competitive in the market.

Once a new product concept has been developed, the next step is to create a prototype.

PLATE V



This picture shows that the maternal P_1 strains give colored seedlings, indicating the presence of $r^R r^R$.

might be written as $AACC\ r^Rr^R$, $AACcr^Rr^R$ and $Aaccr^Rr^R$. The results are in Table XI-a and illustrated in Plate V.

Four ears of Emerson's A-tester corn which were selfed in 1926 were planted in sand boxes and produced all non-colored seedlings. The data will be found in Table XI-b. The composition of the Emerson A-tester was either $aaCCR^SRS$, or $aaCCR^RRS$, or $aaCCR^Rr^R$.

Assuming the first type to be the case, in the F_1 generation, the seedlings from any of the following crosses should be colored because r^R is dominant over RS .

-Maternal strains-		-Emerson's A-tester-
$AACCr^Rr^R$	X	$aaCCR^SRS$
$AACcr^Rr^R$	X	$aaCCR^RRS$
$Aaccr^Rr^R$	X	$AACCR^SRS$

Unfortunately, there were no remnants of F_1 seeds left, so there is no way to get data for this generation. This supposition therefore, remains to be proved by the seedling behavior in the later generations.

Seedling behavior in the F_2 and F_3 generations

Remnants of 66 F_2 ears used for planting in 1925 were tested. They were colored kernels from both 9:7 ears and 27:37 ears. All were planted in sand boxes in the laboratory. If the hypothesis at hand is right, the F_2 colored seeds either from the 9:7 ears or from the 27:37 ears must give colored and non-colored seedlings in the proportion of 2 to 1 according to the following factorial diagrams in which the F_3 behaviors are also shown.

Diagram a. Colored seeds of 9:7 F_2 ears from
 $AACCr^Rr^R \times aaCCr^Rr^R$.

Genotypic Ratio	F_2 genotypes	Proportion of seedling color	F_3 behavior
1	$AACCr^Rr^R$ giving non-colored seedlings	1	breeds true for non-colored seedlings
2	$AaCCr^Rr^R$ giving " "		1 $AACCr^Rr^R$ } all non-colored seedlings 2 $AaCCr^Rr^R$ } 1 $aaCCr^Rr^R$ }
2	$AACCr^Rr^R$ giving colored seedlings	2	1 $AACCr^Rr^R$ } colored seeds giving 2:1 of colored and non-colored seedlings 2 $AaCCr^Rr^R$ }
4	$AaCCr^Rr^R$ giving colored seedlings		1 $AACCr^Rr^R$ } Colorless seeds giving only colored seedlings 2 colored; 1 non-colored seedlings as in F_2

Diagram b. Colored seeds of 27:37 F_2 ears from
 $AACcr^Rr^R \times aaCCr^Rr^R$.

Genotypic Ratio	F_2 genotypes	Proportion of seedling color	F_3 seedling behavior
1	$AACCr^Rr^R$ non-colored seedlings	1	Breeds true for non-colored seedlings
2	$AaCCr^Rr^R$ " " "		1 $AACCr^Rr^R$ } all non-colored seedlings 2 $AaCCr^Rr^R$ } 1 $aaCCr^Rr^R$ }
2	$AACCr^Rr^R$ " " "		1 $AACCr^Rr^R$ } all non-colored seedlings 2 $AaCCr^Rr^R$ } 1 $aaCCr^Rr^R$ }
4	$AaCCr^Rr^R$ " " "		
2	$AACCr^Rr^R$ colored seedlings	2	1 $AACCr^Rr^R$ non-colored seedling 2 $AaCCr^Rr^R$ colored "
4	$AaCCr^Rr^R$ " " "		1 $AACCr^Rr^R$ all colored "
4	$AaCCr^Rr^R$ " " "		2:1 colored and non-colored as in F_2
4	$AaCCr^Rr^R$ " " "		2:1 colored and non-colored as in F_2
8	$AaCCr^Rr^R$ " " "		2:1 colored and non-colored as in F_2

TABLE XII. Colored seeds from 9:7 F_2 ears and 27:37 F_2 ears gave colored and non-colored seedlings in a ratio of 2:1, thus indicating the segregation of the alleomorphic pair $R\bar{S}r^r$.

Name of Variety	Accession No.	1923 (F_1) selection No.	1924 (F_2) selection No.	Ratio of ear	Number of seedlings-		
					Colored	Non-colored	
White Cob. Duncan	235	301150	40701	27:37	16	6	
			40702	"	6	6	
			40703	"	3	1	
		301150	40705	"	4	3	
			40708	"	4	2	
			40710	"	13	7	
		301151	40802	"	6	6	
			40803	"	0	3	
			40807	9:7	13	11	
White Cob. G.Glow X White Cob. Duncan	254	30255	40901	27:37	7	3	
			40902	"	1	2	
		30256	41002	"	15	7	
			30331	41102	9:7	17	6
			41109	"	19	7	
			41113	"	13	6	
			41114	"	10	8	
			41118	"	11	7	
			41119	"	12	8	
		30332	41201	"	7	4	
			41211	"	9	4	

TABLE XII (continued)

Name of Variety	Accession No.	1923	1924	Ratio of ear	Number of seedlings-	
		(F ₁) selec- tion No.	(F ₂) selec- tion No.		Colored	Non-colored
	254 (continued)	30332	41212	9:7	12	4
			41213	27:37	4	1
			41216	"	16	7
		30333	41311	"	0	18
			41312	"	14	7
			41313	"	1	0
		30408	41401	9:7	2	1
			41409	"	9	5
			41413	"	12	7
		30409	41503	"	15	6
			41504	27:37	6	2
			41507	"	5	4
		30513	41602	9:7	14	6
			41604	"	13	8
			41605	"	8	5
		30514	41701	"	11	6
		30515	41802	"	17	6
			41810	"	16	9
			41816	27:37	7	3
		30604	41902	"	7	4
			41905	9:7	15	8
		30702	42002	"	8	4

• • •

1. *Chlorophyll a* (Chl *a*)

TABLE XII (continued)

Name of Variety	Accession No.	1923	1924	Ratio of ear	Number of seedlings	
		(F ₁) selection No.	(F ₂) selection No.		Colored	Non-colored

254						
(continued)						
		30806	42203	9:7	9	5
			42209	"	14	7
		30904	42401	27:37	11	8
		31008	42505	9:7	15	5
			42516	27:37	3	1
		31009	42602	"	7	2
		31011	42701	27:37	17	6
			42708	9:7	14	7
		31111	42802	27:37	11	6
		31112	42906	"	2	1
		31113	43004	"	8	3
		31306	43603	"	9	5
		31308	43803	9:7	12	9
Nelson X Bailey	255	31430	44001	27:37	15	6
		31431	44101	"	5	2
			44104	"	12	6
		31432	44207	"	4	1
		31604	44304	9:7	10	12
			44306	27:37	3	0
			44311	"	11	5

1. Introduction

The purpose of this report is to provide a comprehensive overview of the current state of the market for [insert product/service]. The report will analyze the market's growth, challenges, and opportunities, and will provide recommendations for [insert company/organization].

2. Market Overview

The market for [insert product/service] is currently experiencing rapid growth, driven by increasing demand for [insert product/service] and the entry of new players into the market. The market is characterized by a high degree of competition, with [insert company/organization] being one of the leading players. The market is also characterized by a high degree of volatility, with prices fluctuating significantly over the past few years.

The market is currently facing several challenges, including increasing competition, rising costs, and changing consumer preferences. However, there are also several opportunities for [insert company/organization], including the potential for expansion into new markets, the development of new products, and the implementation of more efficient production processes. The report will provide a detailed analysis of these challenges and opportunities, and will provide recommendations for [insert company/organization] to address them.

TABLE XII (continued)

Name of Variety	Accession No.	1923 (F ₁) selection No.	1924 (F ₂) selection No.	Ratio of ear	Number of seedlings	
					Colored	Non-colored
	255	31703	44503	27:37	3	2
(continued)		31704	44609	"	1	2
		32201	45502	"	5	2
		32301	45702	"	<u>2</u>	<u>1</u>
		66 ears				
		Actual total . . . 601 320				
		Expected total (2:1) . . 614 307				
		Deviation -13 +13				
		<u>Dev.</u> = <u>13</u> = 1.4				
		P.E. 9.6				

Such was proved to be the case. Colored seeds of these 66 F_2 remnant ears gave a total of 601 colored seedlings and 320 non-colored seedlings where 614 colored seedlings and 307 non-colored seedlings were expected. This exhibits a deviation of 13, which is only 1.4 times its probable error, indicating that observations were very close to expectancy. The results are arranged in Table XII.

Unfortunately, many of the F_3 ears had been thrown away before this seedling situation was fully realized. Those ears which remained were tested in two groups, i.e. those derived from the colored individuals of the 9:7 F_2 ears and those derived from the colored individuals of the 27:37 F_2 ears.

F_3 seedling behavior in the 9:7 F_2 group

In this group 6 F_3 homozygous colored ears (1:0) gave only non-colored seedlings. The results are shown in Table XIII-a. Here is a critical test for the hypothesis indicated in diagram a. These colored seeds of 1:0 F_3 ears should carry the $R^G R^G$ factor in order to produce non-colored seedlings in presence of the Δ factor. The $R^G R^G$ must have come from Emerson's Δ -tester ($aaCCR^G R^G$) in order that the 1:0 F_3 ears could have the constitution $AACCR^G R^G$ because it has been shown, Table XI-a, that $r^R r^R$ came from the maternal P_1 strains. Otherwise, these 1:0 F_3 's, indicated in Table XIII-a, would not produce all non-colored seedlings.

One hundred and nine 3:1 F_3 ears showed all non-colored seedlings either from the colored seeds or from the colorless seeds. These

ears were proved¹ to be the A-tester types (aCr in Table IX-a) with respect to their colorless seeds. Consequently, they must have contained $R^E R^E$ in order to produce all non-colored seedlings in presence of the A factor. The data are set forth in Table XIII-b.

Table XIII-c shows that another set of 97 3:1 F_3 ears gave 1684 colored seedlings and 681 non-colored seedlings from the colored seeds and gave only 2063 colored seedlings from the colorless seeds. Expected numbers of colored and non-colored seedlings for the former are 1710:655 on a basis of 2:1. The deviation is 26, which is 1.6 times its probable error. This explains the fact that all these ears have been proved to be the R-tester type (ACr) with regard to their colorless seeds (see Table IX-a). They came from the F_2 genotype $AACCR^E r^r$ (diagram a). Consequently, from such 3:1 F_3 ears the seeds with $AACCR^E r^r$ would give colored seedlings and the seeds with $AACCR^E R^E$ would produce non-colored seedlings in the proportion of 2 to 1. The colorless seeds with $AACCr^r r^r$ of the same ear would produce all colored seedlings on account of the presence of r^r in addition to the A factor.

Colored seeds from 43 9:7 F_3 ears gave a total of 831 colored seedlings and 458 non-colored seedlings where 859.3:429.7 are expected

1 Not all of the 3:1 F_3 ears were included in the 1926 planting. The ears which were selected for crossing with Emerson's testers were chosen because of characteristics other than those affected by R^E or r^r and hence the ears reported in Tables IX-a and IX-b may be considered to be random samples of the ears tested in the sand trays, and the results obtained by the field crosses may be considered as typical for the various types of seedlings. The same holds true for the other results from 3:1 F_3 ears mentioned in this section.

1. The first step in the process of identifying a problem is to recognize that a problem exists. This is often done by comparing current performance with a desired state or goal. If there is a discrepancy, a problem is identified.

2. Once a problem is identified, the next step is to define the problem more precisely. This involves determining the scope of the problem, the resources available, and the constraints that may affect the solution.

3. The third step is to generate potential solutions. This can be done through brainstorming, research, or consulting with experts. The goal is to come up with a range of possible options to address the problem.

4. The fourth step is to evaluate the potential solutions. This involves weighing the pros and cons of each option, considering the resources required, and assessing the potential impact of each solution.

5. The fifth step is to select a solution. This is done by choosing the option that best meets the criteria established in the previous steps. It is important to consider the long-term implications of the chosen solution.

6. The sixth step is to implement the solution. This involves putting the chosen solution into action and monitoring its progress. It is important to be flexible and willing to make adjustments as needed.

7. The seventh step is to evaluate the results. This involves comparing the actual outcomes with the desired outcomes to determine the effectiveness of the solution. If the solution is not working, it may be necessary to go back to an earlier step.

8. The eighth step is to document the process. This involves recording the steps taken, the solutions generated, and the results achieved. This documentation can be useful for future reference and for sharing the experience with others.

9. The final step is to reflect on the process. This involves thinking about what was learned from the experience and how it can be applied to future problems.

TABLE XIII-a. Showing that only non-colored seedlings were produced by the 1:0 F_3 ears which were progenies of the 9:7 F_2 group.

1925 (F_3) Selection No.	Number of seedlings	
	Colored	Non-colored
53901	0	18
53902	0	16
54101	0	14
55401	0	8
56001	0	24
56002	<u>0</u>	<u>20</u>
Total	0	100

Date		Description		Amount	
1900	Jan 1	Balance		100.00	
		Jan 10	Jan 10	50.00	
		Jan 20	Jan 20	25.00	
		Jan 30	Jan 30	10.00	
		Feb 1	Feb 1	10.00	
		Feb 10	Feb 10	50.00	
		Feb 20	Feb 20	25.00	
		Feb 30	Feb 30	10.00	
		Mar 1	Mar 1	10.00	
		Mar 10	Mar 10	50.00	
		Mar 20	Mar 20	25.00	
		Mar 30	Mar 30	10.00	
		Apr 1	Apr 1	10.00	
		Apr 10	Apr 10	50.00	
		Apr 20	Apr 20	25.00	
		Apr 30	Apr 30	10.00	
		May 1	May 1	10.00	
		May 10	May 10	50.00	
		May 20	May 20	25.00	
		May 30	May 30	10.00	
		Jun 1	Jun 1	10.00	
		Jun 10	Jun 10	50.00	
		Jun 20	Jun 20	25.00	
		Jun 30	Jun 30	10.00	
		Jul 1	Jul 1	10.00	
		Jul 10	Jul 10	50.00	
		Jul 20	Jul 20	25.00	
		Jul 30	Jul 30	10.00	
		Aug 1	Aug 1	10.00	
		Aug 10	Aug 10	50.00	
		Aug 20	Aug 20	25.00	
		Aug 30	Aug 30	10.00	
		Sep 1	Sep 1	10.00	
		Sep 10	Sep 10	50.00	
		Sep 20	Sep 20	25.00	
		Sep 30	Sep 30	10.00	
		Oct 1	Oct 1	10.00	
		Oct 10	Oct 10	50.00	
		Oct 20	Oct 20	25.00	
		Oct 30	Oct 30	10.00	
		Nov 1	Nov 1	10.00	
		Nov 10	Nov 10	50.00	
		Nov 20	Nov 20	25.00	
		Nov 30	Nov 30	10.00	
		Dec 1	Dec 1	10.00	
		Dec 10	Dec 10	50.00	
		Dec 20	Dec 20	25.00	
		Dec 30	Dec 30	10.00	
		Total		1000.00	

TABLE XIII-b. Showing that only non-colored seedlings resulted from both colored and colorless kernels of 109 3:1 F_3 ears, progenies of the 9:7 F_2 group, indicating the presence of R⁸H⁸.

1925 (F_3) Selec- tion No.	From colored <u>kernels</u> <u>-seedlings-</u> colored color- less		From color- <u>less kernels</u> <u>-seedlings-</u> colored color- less		1925 (F_3) Selec- tion No.	From colored <u>kernels</u> <u>-seedlings-</u> colored color- less		From color- <u>less-kernels</u> <u>-seedlings-</u> colored color- less	
53404	0	24	0	25	54304	0	20	0	23
53405	0	22	0	23	54305	0	15	0	19
53908	0	20	0	11	54306	0	20	0	18
53910	0	25	0	20	54308	0	25	0	21
53911	0	23	0	18	54310	0	21	0	20
53912	0	24	0	21	54312	0	23	0	20
53915	0	23	0	22	54403	0	25	0	19
53918	0	25	0	23	54404	0	20	0	23
54004	0	24	0	21	54405	0	19	0	21
54006	0	23	0	20	54408	0	20	0	24
54007	0	21	0	15	54505	0	19	0	24
54008	0	24	0	22	54509	0	20	0	15
54009	0	24	0	21	54512	0	25	0	23
54106	0	25	0	23	54513	0	24	0	15
54107	0	24	0	25	54514	0	14	0	13
54108	0	26	0	24	54515	0	20	0	24
54110	0	21	0	23	54605	0	21	0	21
54112	0	24	0	25	54607	0	24	0	25
54116	0	21	0	20	54608	0	20	0	15
54117	0	21	0	20	54703	0	25	0	20
54118	0	21	0	15	54705	0	21	0	15

TABLE XIII-b (continued)

1925 (F ₃) Selec- tion No.	From colored <u> kernels </u> <u>-seedlings-</u> colored color- less		From color- <u>less kernels</u> <u>-seedlings-</u> colored color- less		1925 (F ₃) Selec- tion No.	From colored <u> kernels </u> <u>-seedlings-</u> colored color- less		From color- <u>less kernels</u> <u>-seedlings-</u> colored color- less	
54708	0	19	0	24	55602	0	24	0	24
54905	0	25	0	21	55603	0	25	0	25
54906	0	25	0	22	55605	0	23	0	27
54908	0	23	0	21	55902	0	22	0	21
54913	0	25	0	21	55903	0	25	0	23
55005	0	26	0	25	55904	0	25	0	21
55006	0	26	0	20	55907	0	24	0	19
55007	0	25	0	23	55909	0	25	0	20
55009	0	23	0	25	56006	0	22	0	21
55405	0	24	0	20	56007	0	23	0	23
55408	0	5	0	19	56008	0	21	0	24
55409	0	27	0	20	56106	0	23	0	25
55410	0	25	0	20	56107	0	25	0	21
55411	0	21	0	19	56202	0	24	0	25
55502	0	25	0	20	56203	0	21	0	19
55504	0	19	0	15	56204	0	22	0	20
55505	0	25	0	21	56206	0	23	0	24
55508	0	24	0	24	56302	0	25	0	22
55509	0	24	0	20	56303	0	24	0	23
55510	0	25	0	21	56307	0	27	0	24
55511	0	24	0	22	56502	0	21	0	20
55512	0	25	0	23	56503	0	25	0	20

TABLE XIII-b (continued)

1925 (F ₃) Selec- tion No.	From colored <u>kernels</u> <u>-seedlings-</u> colored color- less		From color- <u>less kernels</u> <u>-seedlings-</u> colored color- less		1925 (F ₃) Selec- tion No.	From colored <u>kernels</u> <u>-seedlings-</u> colored color- less		From color- <u>less kernels</u> <u>-seedlings-</u> colored color- less	
56506	0	25	0	20	58108	0	24	0	25
56608	0	26	0	25	58303	<u>0</u>	<u>25</u>	<u>0</u>	<u>24</u>
56609	0	25	0	24	Total ... 0 .. 2504 0 .. 2261				
56703	0	24	0	25					
57003	0	23	0	24					
57004	0	25	0	19					
57006	0	21	0	15					
57104	0	24	0	18					
57105	0	25	0	19					
57203	0	24	0	19					
57302	0	23	0	20					
57303	0	24	0	18					
57304	0	25	0	15					
57305	0	25	0	16					
57402	0	25	0	17					
57403	0	24	0	18					
57703	0	23	0	20					
57706	0	25	0	21					
58103	0	24	0	25					
58106	0	23	0	21					
58107	0	22	0	20					

TABLE XIII-c. Showing that the colored kernels from 97 3:1 F_3 ears of the 9:7 $\frac{1}{2}$ group gave colored and non-colored seedlings in ratio of 2:1 indicating the presence of R^Rr^R and R^Rr^R respectively while the colorless kernels of the same ears gave only colored seedlings indicating the presence of r^Rr^R .

1925 (F_3) Selection No.	From colored kernels		From colorless kernels	
	colored seedlings	colorless seedlings	colored seedlings	colorless seedlings
51601	19	12	5	0
51602	16	7	25	0
51603	19	9	24	0
53403	18	10	23	0
53904	14	5	22	0
53905	23	5	22	0
53906	18	8	22	0
53907	17	9	24	0
53909	21	10	17	0
53913	14	7	25	0
53914	16	7	12	0
53916	20	7	17	0
53917	15	9	10	0
53919	15	7	24	0
54005	19	10	24	0
54010	16	6	12	0
54103	18	10	16	0
54104	15	8	18	0
54105	13	5	18	0
54109	20	13	23	0
54111	17	12	11	0

1. The first part of the document is a title page. It contains the title of the document, the author's name, and the date of the document.

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10. The tenth part of the document is a list of bibliography. It lists the references used in the document.

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TABLE XIII-c (continued)

1925 (F ₃) Selection No.	From colored kernels		From colorless kernels	
	colored seedlings	colorless seedlings	colored seedlings	colorless seedlings
54113	12	7	17	0
54114	10	8	20	0
54115	25	14	22	0
54203	16	12	15	0
54204	15	6	24	0
54205	21	16	19	0
54207	13	8	20	0
54208	13	8	19	0
54213	11	6	20	0
54307	11	6	23	0
54309	22	9	20	0
54311	14	12	22	0
54313	14	8	24	0
54406	15	10	22	0
54407	16	9	22	0
54503	13	9	22	0
54506	17	8	23	0
54507	19	7	25	0
54508	18	7	22	0
54510	15	8	25	0
54511	18	8	23	0
54604	15	7	21	0
54606	19	8	23	0

TABLE XIII-c (continued)

1925 (F ₃) Selection No.	From colored kernels		From colorless kernels	
	colored seedlings	colorless seedlings	colored seedlings	colorless seedlings
54704	21	9	25	0
54706	17	8	23	0
54707	18	8	24	0
54907	21	9	22	0
54909	18	7	23	0
54910	19	8	25	0
54911	21	8	21	0
54912	10	4	22	0
55004	17	10	14	0
55008	15	9	19	0
55010	18	10	17	0
55404	18	8	25	0
55406	16	10	20	0
55407	15	8	27	0
55412	19	11	24	0
55503	14	6	22	0
55506	20	8	21	0
55507	20	7	24	0
55604	20	11	23	0
55905	21	10	24	0
55906	20	12	23	0
55908	23	10	24	0
55910	19	11	24	0

TABLE XIII-c (continued)

1925 (F ₃) Selection No.	From colored kernels		From colorless kernels	
	colored seedlings	colorless seedlings	colored seedlings	colorless seedlings
56004	16	8	25	0
56005	18	8	24	0
56009	11	5	25	0
56010	23	9	24	0
56102	17	8	21	0
56103	13	10	22	0
56104	14	9	23	0
56105	11	6	21	0
56205	13	9	25	0
56304	23	9	25	0
56305	15	9	26	0
56306	14	8	20	0
56504	14	9	24	0
56505	21	10	22	0
56604	14	9	23	0
56605	18	10	21	0
56606	14	9	21	0
56607	17	10	19	0
56704	19	9	20	0
57005	16	9	21	0
57103	20	10	23	0
57202	27	10	25	0
57306	12	7	21	0

TABLE XIII-c (continued)

1925 (F ₃) Selection No.	From colored kernels		From colorless kernels	
	colored seedlings	colorless seedlings	colored seedlings	colorless seedlings
57404	32	17	24	0
57704	23	10	24	0
57705	20	11	25	0
58104	23	12	19	0
58105	17	9	21	0
58302	23	12	25	0
58304	<u>21</u>	<u>11</u>	<u>21</u>	<u>0</u>

TOTAL (97 ears)

Actual . . . 1684 . . . 881 2083 0

Expected . 1710 . . . 855

Deviation . -26 . . . +26

$$\frac{\text{Dev.}}{\text{P.E.}} = \frac{26}{16.1} = 1.6$$

1. Introduction

The purpose of this study is to investigate the effects of the proposed system on the performance of the participants. The study was conducted in a controlled environment and the results are presented in the following sections.

2. Methodology

The study was conducted in a controlled environment. The participants were divided into two groups: the control group and the experimental group. The control group received the standard training, while the experimental group received the proposed system. The performance of the participants was measured using a series of tests. The results of the tests are presented in the following sections.

3. Results

The results of the study are presented in the following sections.

The first result is the performance of the participants.

The second result is the time taken by the participants.

The third result is the number of errors made by the participants.

TABLE XIII-d. Showing that colored seeds of 43 9:7 F₃ ears of the 9:7 F₂ group gave 2:1 ratio of colored to non-colored seedlings.

1925 (F ₃) Selection No.	Number of seedlings		1925 (F ₃) Selection No.	Number of seedlings	
	Colored	Non-colored		Colored	Non-colored
51604	22	6	55613	24	15
51606	26	10	55614	24	11
51608	20	11	55616	21	15
53920	20	11	55617	17	11
53925	24	9	55618	16	11
53926	22	8	56015	23	11
53929	18	12	56016	14	11
53931	11	9	56311	13	7
54013	21	13	56312	13	9
54016	20	11	56315	16	11
54018	17	12	56512	12	7
54126	13	7	56513	16	9
54127	20	9	56616	20	11
54128	24	9	56710	22	7
54129	23	11	57011	26	12
54133	23	14	57308	15	10
54516	23	12	57309	21	9
54518	18	11	57710	15	9
54610	23	11	57712	14	8
54620	17	10	57713	<u>18</u>	<u>12</u>
54624	23	12	Actual total	831	458
54710	21	12	Theoretical		
54712	22	12	total	859.3	429.7
			Deviation	-28.3	+28.3
			Dev. =	<u>28.3</u>	= 2.4
			P.E.	11.3	

on the basis of 2:1. This shows a deviation of 26.3 which is 2.4 times its probable error. Obviously, observations coincide with expectation fairly well. The results are seen in Table XIII-d.

F_3 seedling behavior in the 27:37 F_2 group

In this group it should be remembered that the F_3 ears are of four kinds of Mendelian ratios. They are 1:0, 3:1, 9:7, and 27:37 ratios.

Five of 1:0 F_3 ears were tested for $R^E R^E$ and they all gave non-colored seedlings. This is just what would be expected, from results in the group of 1:0 F_3 ears from 9:7 F_3 ears, and gives substantial support to the hypothesis formulated in diagrams a and b. The results are listed in Table XIV-a.

Table XIV-b shows that a total of 117 F_3 3:1 ears gave all non-colored seedlings from both the colored and the colorless seeds. Therefore, they all carried $R^E R^E$ (see diagram b) as expected. It should be recalled that some of these ears had colorless seeds which proved to be the A-tester types and that some of them had colorless seeds which proved to be the C-tester types, as was shown in Table IX-b. Here is another critical test in support of the hypothesis. It was the $R^E R^E$ factor which caused the C-tester type to be indistinguishable from the A-tester type in the seedling tests. The C-tester type would be easily rogued out by the seedling test, if either $R^R R^R$ or $R^E R^R$ were present.

Fifty-six 3:1 F_3 ears, as shown in Table XIV-c, were known as the R-tester types. The colored seeds gave 1051 colored seedlings

TABLE XIV-a. Showing that only non-colored seedlings resulted from 5 1:0 F_3 ears which were progenies of the 27:37 F_2 group, conclusively indicating the presence of $R_{S_1}^G$ ($\Delta\Delta CCRS_{S_1}^G$).

1925 (F_3) Selection No.	Number of seedlings	
	Colored	non-colored
51901	0	18
51902	0	19
53801	0	16
57201	0	16
59101	<u>0</u>	<u>19</u>
Total	0	88

TABLE XIV-b. Showing that 117 F₃ ears, progenies of the 27:37 F₂ group, gave all non-colored seedlings from both colored and colorless seeds, thereby indicating presence of R₂L₂.

1925 (F ₃) Selec- tion No.	From colored kernels		From color- less kernels		1925 (F ₃) Selec- tion No.	From colored kernels		From color- less kernels	
	-seedlings-		-seedlings-			-seedlings-		-seedlings-	
	colored	color- less	colored	color- less		colored	color- less	colored	color- less
51201	0	25	0	24	52201	0	23	0	26
51202	0	26	0	25	52202	0	22	0	24
51204	0	25	0	26	52204	0	23	0	25
51205	0	26	0	27	52205	0	24	0	21
51304	0	24	0	19	52301	0	22	0	23
51305	0	25	0	20	52401	0	25	0	24
51402	0	23	0	21	52504	0	24	0	25
51403	0	22	0	19	52508	0	21	0	21
51405	0	25	0	20	52602	0	25	0	20
51406	0	24	0	16	52603	0	25	0	21
51502	0	25	0	15	52701	0	26	0	24
51504	0	26	0	6	52702	0	24	0	20
51701	0	25	0	20	52703	0	25	0	21
51703	0	26	0	21	52803	0	20	0	19
51704	0	24	0	22	52902	0	25	0	21
51705	0	22	0	19	53002	0	26	0	23
51706	0	21	0	18	53004	0	24	0	24
51801	0	20	0	20	53005	0	25	0	25
51802	0	25	0	20	53006	0	25	0	20
52002	0	24	0	21	53202	0	25	0	20
52003	0	24	0	20	53203	0	21	0	21
52101	0	25	0	25	53205	0	24	0	24

TABLE XIV-b (continued)

1925 (F ₃) Sele- ction No.	From colored kernels -seedlings- colored color- less		From color- less kernels -seedlings- colored color- less		1925 (F ₃) Sele- ction No.	From colored kernels -seedlings- colored color- less		From color- less kernels -seedlings- colored color- less	
53207	0	23	0	23	55703	0	21	0	17
53302	0	24	0	24	55704	0	22	0	18
53303	0	25	0	25	55802	0	23	0	11
53304	0	24	0	21	55803	0	24	0	19
53306	0	24	0	22	55804	0	23	0	20
53501	0	25	0	19	56401	0	24	0	24
53601	0	22	0	18	56402	0	24	0	24
53803	0	23	0	19	56403	0	25	0	20
53804	0	24	0	20	56801	0	25	0	21
53805	0	25	0	21	56802	0	25	0	23
54801	0	25	0	23	56804	0	24	0	20
54802	0	26	0	24	56902	0	26	0	23
54805	0	27	0	21	56903	0	23	0	24
55103	0	25	0	25	56905	0	24	0	20
55202	0	24	0	21	57501	0	25	0	21
55203	0	22	0	24	57602	0	21	0	19
55205	0	23	0	25	57603	0	23	0	18
55302	0	24	0	20	57802	0	24	0	15
55303	0	25	0	21	57901	0	21	0	12
55304	0	26	0	23	58002	0	24	0	17
55305	0	24	0	20	58004	0	25	0	18
55307	0	24	0	19	58201	0	25	0	16
55702	0	22	0	15	58202	0	20	0	19

Table 1

Name of the person		Date of birth		Date of death	
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9
10	10	10	10	10	10
11	11	11	11	11	11
12	12	12	12	12	12
13	13	13	13	13	13
14	14	14	14	14	14
15	15	15	15	15	15
16	16	16	16	16	16
17	17	17	17	17	17
18	18	18	18	18	18
19	19	19	19	19	19
20	20	20	20	20	20
21	21	21	21	21	21
22	22	22	22	22	22
23	23	23	23	23	23
24	24	24	24	24	24
25	25	25	25	25	25
26	26	26	26	26	26
27	27	27	27	27	27
28	28	28	28	28	28
29	29	29	29	29	29
30	30	30	30	30	30
31	31	31	31	31	31
32	32	32	32	32	32
33	33	33	33	33	33
34	34	34	34	34	34
35	35	35	35	35	35
36	36	36	36	36	36
37	37	37	37	37	37
38	38	38	38	38	38
39	39	39	39	39	39
40	40	40	40	40	40
41	41	41	41	41	41
42	42	42	42	42	42
43	43	43	43	43	43
44	44	44	44	44	44
45	45	45	45	45	45
46	46	46	46	46	46
47	47	47	47	47	47
48	48	48	48	48	48
49	49	49	49	49	49
50	50	50	50	50	50
51	51	51	51	51	51
52	52	52	52	52	52
53	53	53	53	53	53
54	54	54	54	54	54
55	55	55	55	55	55
56	56	56	56	56	56
57	57	57	57	57	57
58	58	58	58	58	58
59	59	59	59	59	59
60	60	60	60	60	60
61	61	61	61	61	61
62	62	62	62	62	62
63	63	63	63	63	63
64	64	64	64	64	64
65	65	65	65	65	65
66	66	66	66	66	66
67	67	67	67	67	67
68	68	68	68	68	68
69	69	69	69	69	69
70	70	70	70	70	70
71	71	71	71	71	71
72	72	72	72	72	72
73	73	73	73	73	73
74	74	74	74	74	74
75	75	75	75	75	75
76	76	76	76	76	76
77	77	77	77	77	77
78	78	78	78	78	78
79	79	79	79	79	79
80	80	80	80	80	80
81	81	81	81	81	81
82	82	82	82	82	82
83	83	83	83	83	83
84	84	84	84	84	84
85	85	85	85	85	85
86	86	86	86	86	86
87	87	87	87	87	87
88	88	88	88	88	88
89	89	89	89	89	89
90	90	90	90	90	90
91	91	91	91	91	91
92	92	92	92	92	92
93	93	93	93	93	93
94	94	94	94	94	94
95	95	95	95	95	95
96	96	96	96	96	96
97	97	97	97	97	97
98	98	98	98	98	98
99	99	99	99	99	99
100	100	100	100	100	100

TABLE XIV-b (continued)

1925 (F ₃) Sele- ction No.	From colored kernels <u>-seedlings-</u> colored color- less		From color- less kernels <u>-seedlings-</u> colored color- less		1925 (F ₃) Sele- ction No.	From colored kernels <u>-seedlings-</u> Colored color- less		From color- less kernels <u>-seedlings-</u> colored color- less	
58204	0	24	0	20	59003	0	23	0	23
58403	0	25	0	19	59102	0	25	0	19
58404	0	25	0	20	59103	0	21	0	17
58405	0	25	0	15	59204	0	25	0	18
58406	0	21	0	16	59205	0	24	0	21
58407	0	24	0	17	59206	<u>0</u>	<u>25</u>	<u>0</u>	<u>23</u>
58409	0	23	0	12	Total...	0 ...	2792.....	0 ..	2404
58501	0	24	0	18					
58502	0	25	0	20					
58602	0	25	0	21					
58603	0	20	0	23					
58604	0	22	0	24					
58701	0	27	0	23					
58702	0	25	0	24					
58704	0	25	0	25					
58802	0	21	0	19					
58803	0	24	0	20					
58902	0	25	0	21					
58903	0	24	0	23					
58904	0	21	0	24					
59002	0	21	0	21					

TABLE XIV-c. Showing that 56 3:1 F_3 ears of the 27:37 F_2 group gave colored and colorless seedlings in a ratio of 2:1 from colored seeds thereby indicating presence of $R^G r^r$ and $R^G R^G$ respectively and only colored seedlings from colorless seeds thereby indicating $r^r r^r$.

1925 (F_3) Selection No.	From colored seeds		From colorless seeds	
	colored seedlings	colorless seedlings	colored seedlings	colorless seedlings
51203	17	10	20	0
51301	18	10	22	0
51302	21	7	24	0
51303	19	9	22	0
51404	14	6	23	0
51407	23	11	32	0
51413	19	10	27	0
51503	20	29	30	0
51702	8	4	21	0
51707	18	8	19	0
51803	22	10	15	0
51904	13	8	11	0
51905	19	13	22	0
51906	15	9	23	0
52001	18	10	26	0
52203	15	8	25	0
52402	15	10	21	0
52502	25	10	17	0
52503	24	9	24	0
52505	12	7	25	0
52507	15	9	27	0

TABLE XIV-c. (Continued)

1925 (F ₃) Selec- tion No.	From colored seeds		From colorless seeds	
	colored seedlings	colorless seedlings	colored seedlings	colorless seedlings
52510	17	8	18	0
52901	17	9	20	0
52902	13	8	8	0
53003	16	8	7	0
53101	22	14	27	0
53204	12	16	29	0
53206	17	9	25	0
53305	14	8	22	0
53502	13	8	6	0
54804	16	9	17	0
55102	16	8	18	0
55104	18	7	20	0
55204	16	11	14	0
55306	16	9	15	0
55705	13	6	20	0
55805	20	8	21	0
56803	20	9	25	0
56904	19	10	21	0
57803	15	7	25	0
58003	15	6	24	0
58005	11	5	19	0
58203	19	8	23	0

TABLE XIV-c (continued)

1925 (F ₃) Selection No.	From colored seeds		From colorless seeds	
	colored seedlings	colorless seedlings	colored seedlings	colorless seedlings
58402	31	15	24	0
58408	19	11	24	0
58503	19	12	21	0
58504	12	5	23	0
58605	29	11	23	0
58609	29	15	21	0
58703	27	16	24	0
58801	33	20	20	0
58804	33	15	24	0
58905	24	16	22	0
59001	19	11	23	0
59202	35	16	44	0
59203	<u>18</u>	<u>10</u>	<u>25</u>	<u>0</u>
Actual total	1051	571	1215	0
Expected total (2:1)	1081.3 . . .	540.7		
Deviation	-30.3 . . .	+30.3		
<u>Dev.</u> P.E.	$= \frac{30.3}{12.7} = 2.3$			

1. The first part of the document is a title page. It contains the title of the document, the author's name, and the date of the document. The title is "The History of the United States of America". The author is "John Adams". The date is "1776".

2. The second part of the document is a table of contents. It lists the chapters of the document and the page numbers where they begin. The chapters are "The Declaration of Independence", "The Constitution", "The Bill of Rights", "The Federalist Papers", and "The American Revolution". The page numbers are 1, 2, 3, 4, and 5 respectively.

3. The third part of the document is the main body of the text. It is divided into five chapters. The first chapter is "The Declaration of Independence". It discusses the reasons for the American colonies' decision to declare independence from Great Britain. The second chapter is "The Constitution". It discusses the process of drafting the Constitution and the role of the framers. The third chapter is "The Bill of Rights". It discusses the process of drafting the Bill of Rights and the role of the framers. The fourth chapter is "The Federalist Papers". It discusses the arguments for the ratification of the Constitution. The fifth chapter is "The American Revolution". It discusses the events leading up to the Revolution and the role of the Continental Congress.

4. The fourth part of the document is a list of footnotes. It contains references to other documents and sources used in the writing of the document.

5. The fifth part of the document is a list of appendices. It contains additional information related to the main body of the text.

6. The sixth part of the document is a list of references. It contains references to other documents and sources used in the writing of the document.

7. The seventh part of the document is a list of references. It contains references to other documents and sources used in the writing of the document.

and 571 non-colored seedlings, where 1081.3:540.7 of colored to non-colored ones were expected. The deviation of 30.3 is 2.3 times its probable error; thus, the observation is fairly close to expectancy. The colored seedlings were, naturally, $\text{AACCR}^{\text{E}}\text{r}^{\text{r}}$, and the non-colored, $\text{AACCR}^{\text{E}}\text{R}^{\text{E}}$. All colorless seeds from these ears produced only colored seedlings as $\text{r}^{\text{r}}\text{r}^{\text{r}}$ was present. Their genotype was, of course, $\text{AACCr}^{\text{r}}\text{r}^{\text{r}}$ (see diagram b).

As shown in Tables XIV-d and XIV-e, of 56 9:7 ears 43 gave 835:443 of colored to non-colored seedlings where 852:426 are expected on a ratio of 2:1 ($\frac{\text{Dev.}}{\text{P.E.}} = 1.5$), just as in the case of F_2 . The remaining 13 9:7 F_3 ears gave only non-colored seedlings from both colored and colorless seeds. This gives a substantial verification to the hypothesis designated in diagram b (page 70). Theoretically, there are two sorts of 9:7 F_3 ears, one with $\text{R}^{\text{E}}\text{r}^{\text{r}}$, and the other with $\text{R}^{\text{E}}\text{R}^{\text{E}}$ in the proportion of 2:1, hence the 43 9:7 F_3 's should be of the former type and the remaining 13 should be of the latter type. They are practically in a ratio of 2:1 when the deviation of 5.7 is 2.5 times its probable error (2.3). The conclusion is, then, that observations agree fairly well with expectation.

Twenty-nine 27:37 F_3 ears behaved in the same manner as in F_2 giving 652:344 of colored to non-colored seedlings where 664:332 are expected. This results in a deviation of 12, which is only 1.2 times its probable error. Observations are conclusively close to expectancy. The data are arranged in Table XIV-f.

Summarizing the above investigation, all data have accorded

TABLE XIV-d. Showing that 43 9:7 F₃ ears of the 27:37 F₂ group, produced colored and colorless seedlings in the ratio of 2:1, thereby indicating the presence of R⁵R⁺.

1925 (F ₃) Selec- tion No.	Number of seedlings		1925 (F ₃) Selec- tion No.	Number of seedlings	
	colored	non-colored		colored	non-colored
51209	35	22	58505	17	10
51210	34	18	58618	9	4
51212	41	19	58622	13	7
51213	40	21	58625	10	6
51306	23	8	58705	14	10
51308	27	12	58706	8	7
51314	35	14	50711	15	7
51408	35	19	58805	13	6
51409	22	6	58808	16	10
51415	20	9	58809	20	9
51512	12	6	58810	17	10
53806	15	11	58812	16	9
53811	16	9	58813	19	11
53812	19	10	58815	16	9
55310	21	7	58816	12	7
55312	20	10	58817	16	10
56908	14	9	58907	19	10
57205	14	7	58908	14	10
57207	23	13	59005	12	11
			59009	10	4
57507	22	10	Total (43 ears)		
			Actual	835	443
57509	23	14	Expected	852	426
			Deviation	-17	+17
58412	17	11	Dev. = $\frac{17}{11.3} \approx 1.5$		
58417	21	11	P.E.	11.3	

TABLE XIV-e. Showing that 13 9:7 F_3 ears of the 27:37 F_2 group produced only non-colored seedlings from both colored and colorless seeds, thereby indicating the presence of R₂R₃.

1925 (F_3) Selection No.	From colored seeds		From non-colored seeds	
	colored seedlings	non-colored seedlings	colored seedlings	non-colored seedlings
51207	0	40	0	19
51208	0	50	0	25
51211	0	62	0	24
51307	0	51	0	26
51522	0	36	0	33
55311	0	32	0	30
56912	0	30	0	26
57810	0	28	0	24
58506	0	17	0	25
58806	0	25	0	30
58811	0	20	0	29
59007	0	17	0	17
58912	<u>0</u>	<u>17</u>	<u>0</u>	<u>18</u>
Total- 13 ears	0	425	0	759

TABLE XIV-f. Showing that the colored seeds of 29 27:37 F_3 ears of the 27:37 F_2 group give colored and non-colored seedlings in a ratio of 2:1.

1925 (F_3) Selection No.	Number of seedlings		1925 (F_3) Selection No.	Number of seedlings	
	colored	non-colored		colored	non-colored
51214	38	24	58610	20	5
51217	36	20	58620	12	7
51218	40	17	58630	14	8
51219	38	21	58715	20	9
51220	42	18	58911	7	3
51221	39	23	58913	22	13
51315	23	11	58916	12	8
51316	24	14	58920	<u>13</u>	<u>8</u>
51421	20	12	Actual total	652 . . .	344
51520	15	10	Theoretical total (2:1)	664 . . .	332
53813	22	10	Deviation	-12 . . .	+12
53814	20	9	$\frac{\text{Dev.}}{\text{P.E.}} = \frac{12}{10.0} = 1.2$		
55316	22	12			
55317	15	17			
56814	17	10			
56914	17	8			
56919	23	10			
57213	17	9			
57815	17	8			
58318	21	9			
58415	26	11			

with the hypothesis as indicated in diagrams a and b. Therefore, Emerson's A-tester, the male P_1 parent in the original crosses, contained $R^E R^E$ and its constitution was $aaCCR^E R^E$, and the maternal P_1 strains of corn contained $r^R r^R$ and their constitutions may be written as: $AACCr^R r^R$, $AACcr^R r^R$, or $AAccr^R r^R$.

SUMMARY

1. The work was started in 1923 by the late Professor F. A. Spragg and his associates with an aim to develop a commercial corn, called "A-tester Yellow Dent", for the Michigan farmer. Strains of such corn have been developed by this present work.
2. In order to develop this type of corn, 24 strains, which were used for corn breeding work here, were crossed with Emerson's A-tester corn which is a white flint having genetic constitution $aaCRRR$. It was hoped that, in the third generation (F_3), strains of this new corn, having the genetic constitution $aaCRRR$ combined with the yellow dent character from the maternal P_1 strains, would be obtained by genetical breeding processes.
3. All maternal P_1 strains that have been tested were found to be AA and rr , but were inconsistent for the C factor. These results coincide with Dr. Emerson's. Some of the strains were CC , some were Cc , and some others had cc individuals. For instance, strains of M. A. C. had all three forms. Their compositions can be written as: $AACCr$, $AACcr$ and $AAccr$. Nelson X Bailey and Bailey were found to be $AAccr$.

4. When these 3 types of corn, $\Delta\Delta C\Delta rr$, $\Delta\Delta C\Delta rr$ and $\Delta\Delta cc rr$ were crossed with Δ -tester ($aa C\Delta RR$), all F_1 ears were colored, but they bred differently in F_2 when self-pollinated. The F_1 genotype $\Delta\Delta C\Delta Rr$ from $\Delta\Delta C\Delta rr \times aa C\Delta RR$ gave ears in 9:7 ratio of colored to colorless seeds, while the F_1 genotype $\Delta\Delta C\Delta Rr$ from $\Delta\Delta cc rr \times aa C\Delta RR$ produced ears in 27:37 ratios. The cross of $\Delta\Delta C\Delta rr \times aa C\Delta RR$ resulted in 2 F_1 genotypes, $\Delta\Delta C\Delta Rr$ and $\Delta\Delta C\Delta Rr$. This kind of F_1 ears produced both 9:7 ears and 27:37 ears in the F_2 generation in equal numbers.
5. Colored seeds from 9:7 ears and from 27:37 ears bred very differently in F_3 when self-pollinated. The former group gave ears with 1:0, 3:1, and 9:7 ratios of colored to colorless aleurones, in proportion of 1:4:4. Of the 3:1 ears, the colorless seeds were either the R-tester types or the Δ -tester types. The latter types were the ones looked for by the experiment at hand. The other group (27:37 F_2 ears) resulted in ears with 1:0, 3:1, 9:7 and 27:37 ratios of colored to colorless aleurones, in proportion 1:6:12:8. The colorless kernels of the 3:1 ears were of 3 sorts. They were the Δ -, C-, and R-tester types. Only the Δ -tester types were sought by this experiment, because only from them could the Δ -tester strains be developed.
6. The Δ -tester types could be distinguished from the R-tester types by the seedling test as the latter show anthocyanic pigment in seedlings and could be rogued out. However, the Δ -tester types in the 27:37 F_2 group could not be separated out from the C-tester types by this method, because both types resulted in the ears whose

seedlings were non-colored. As the multiple allelomorphic factor R^S was found to be involved in the A-tester types and the C-tester types, the only method of separating these 2 types was to cross them with Emerson's A-, C-, and R-testers in the field. The types which proved to be A-testers, gave colorless ears when crossed with A-testers and gave all-colored ears when crossed with C-testers and with R-testers. The C-tester types produced colorless ears when crossed with C-testers and resulted in all-colored ears when crossed with A-tester and R-tester. The R-tester types produced colorless ears when crossed with R-testers and gave all-colored ears when crossed with A- and C-testers. In such ways the A-tester types have been picked out from the C-tester types.

7. Some statistical data indicate that these A-tester types of corn which lack the A factor are not inferior in height, ear length, and ear weight when compared with the R-tester and the C-tester types which have the A factor.
8. From 371 selfed F_4 ears which were A-tester types, 36 with the yellow dent character were considered as desirable for the strains of the A-tester yellow dent corn. Of these 36 ears, 11 were selected as the most desirable ears and may be used in producing a possible commercial variety called "A-tester Yellow Dent".
9. If such a variety is successfully developed from these strains, it will benefit the farmers a great deal, as this corn will aid them in detecting contamination, which is a menace to the pedigree-corn growers.

1. The first step in the process of creating a new product is to identify a market need. This involves conducting market research to determine what consumers want and what problems they are trying to solve. Once a need is identified, the next step is to develop a concept that addresses this need. This is often done through brainstorming sessions with a team of designers and engineers.

2. After a concept has been developed, the next step is to create a prototype. This is a physical model of the product that allows designers to test and refine their ideas. Prototyping can be done in a variety of ways, from simple 3D printing to more complex methods like CNC machining. The goal is to create a model that is as close to the final product as possible, so that any issues can be identified and corrected before moving forward.

3. Once a prototype has been created, the next step is to conduct a feasibility study. This involves evaluating the technical, financial, and market viability of the product. Technical feasibility involves determining whether the product can be manufactured using current technology. Financial feasibility involves estimating the costs of production and determining whether the product can be sold at a price that covers these costs. Market feasibility involves determining whether there is a sufficient market for the product.

4. If the feasibility study is positive, the next step is to develop a business plan. This document outlines the company's strategy for producing and marketing the product. It includes information about the company's financial goals, marketing strategy, and distribution channels. The business plan is a critical document that helps investors and lenders understand the company's vision and potential for success.

5. Once a business plan has been developed, the next step is to secure funding. This can be done in a variety of ways, from seeking venture capital investment to crowdfunding. The goal is to raise enough money to cover the costs of production and marketing. Once funding has been secured, the company can move forward with production.

6. The final step in the process is to launch the product. This involves creating a marketing campaign to promote the product and get it into the hands of consumers. This can be done through a variety of channels, from social media to traditional advertising. The goal is to create a buzz around the product and generate sales. Once the product has been launched, the company can continue to monitor its performance and make any necessary adjustments.

10. The multiple allelomorphic factors R^G and r^r which are partially responsible for producing anthocyanins in the plant body were found to be involved in the crosses reported in this experiment. Here the factor r^r is recessive for aleurone color and dominant for plant color; it aids in producing anthocyanins in the presence of the A factor. The factor R^G is dominant for aleurone color and recessive for plant color; when it is in homozygous condition, it will cause the plants to be non-colored or green even in the presence of the A factor. It was assumed that r^r was brought into the cross by the maternal P_1 strains ($AAOCr^r r^r$, $AACr^r r^r$ or $AAOCr^r r^r$) and R^G by the A -tester ($aaCCR^G R^G$). This assumption has been conclusively proved to be correct by the seedling color behaviors in the F_2 and F_3 generations.

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