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March 1990

LA MINOTERIE D'HAITI

WHEAT BLEND STUDY II

KSU
KANSAS STATE UNIVERSITY

FOOD & FEED GRAIN INSTITUTE
MANHATTAN, KANSAS 66506

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LA MINOTERIE D'HAITI
WHEAT BLEND STUDY II

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EXECUTIVE SUMMARY

This study was initiated by USAID/Haiti in order to recommend the most suitable blending ratio of Soft Red Winter wheat with Hard Red Winter wheat to produce the most acceptable flour to market in Haiti.

At the request of the mission, it was also decided that the compliance activities initiated by the management of La Minoterie D'Haiti to comply with the "Memorandum of Understanding" also be verified concurrently.

In consultation with the technical staff of the mill, it was decided that a composite mix of Hard Red Winter wheats from the three shipments that were being unloaded be prepared to represent the cross section of available Hard Red Winter wheats. This lot was tempered to the usual 14.5 percent moisture level. This was then mixed with 10 percent, 13 percent, 15 percent, and 20 percent of Soft Red Winter wheat in the laboratory and the blends were prepared. These blends were then milled on a "Chopin Experimental Mill" in the laboratory. Experimental loaves were baked with flours obtained from milling experiments. Based on the visual and physical inspection of these loaves, it was recommended to the director general of La Minoterie D'Haiti that 15 percent Soft Red Winter wheat be blended with Hard Red Winter wheat and that the blend be tempered to 14 percent (1/2 percent less than the 14 1/2 percent tempered wheat moisture generally used) moisture subject to changes to suit any special conditions. It was mutually agreed that this blending ratio be adopted and that it would produce acceptable flour.

Regarding the compliance actions taken to comply with the "Memorandum of Understanding", the following observations were made.

1. In general, there were indications that some reductions had been made in the temporary work force compared to the last visit.

2. Regarding the status of safety and sanitary conditions in the mill, it was verified that quite a few <u>minor</u> jobs had been executed but the major causes of these conditions had not been addressed yet.

3. The receiving wharf scale was still not operational. The cleaning house scale was operational along with the tempered wheat to mill scale and finished flour scale. The new load out weigh bridge was operating. The Son du blé dump scale in the mill was not operational.

4. It was stated by the mill's management that a French consulting team had made a visit to the mill to study power factor conditions in the mill and propose a project for a power factor correction.

5. The major problems relating to the pneumatic system of the mill had not been tackled. The mill's management expressed concern regarding this matter. During discussions with the resident French milling technicians, it was indicated that they were aware of the situation and were trying to formulate some remedies.

Conclusions and Recommendations

In conclusion, it was decided in consultation with the technical staff of La Minoterie D'Haiti that 15 percent of Soft Red Winter wheat, blended with Hard Red Winter wheat and tempered to 1/2 percent less than the 14.5 percent tempered wheat moisture that is normally, used would be appropriate for the present milling conditions. The above blending percentage is subject to being raised or lowered with the range of 20 percent - 10 percent as suited to particular situations in the future. For the blending ratio suggested, no changes are expected to be made in the mill flow sheet.

In order to maintain the present mill load or higher, the flour extraction rates might have to be adjusted slightly.

Efforts were being made to improve the safety and sanitary conditions in the mill. But, the major causes of the present conditions had not been addressed. Work on the pneumatic system to improve the choke situation had not been started. The wharf scale was still not operational and management needs to bring all scales into operation quickly. On the basis of observations made during the visit, it appeared that some reductions had been made in the temporary work force.

SECTION I

Introduction

The purpose of the visit in October 1989 was to study and recommend the most suitable blending ratio of Soft Red Winter (SRW) with Hard Red Winter (HRW) wheat to produce the most acceptable flour to market in Haiti.

Concurrently, it was also the purpose of that visit to verify how well the "Memorandum of Understanding" (MOU) which was signed earlier was being complied with.

The following sections of the report present a description of the receiving, cleaning, and tempering systems of the mill, explanation of wheat blending and the conclusions made, concise reports on the compliance activities, and specific conclusions and recommendations.

Daily visits were made to La Minoterie D'Haiti. The information presented herein was given by the mill's technical staff. Due to the very short duration of the visit, the observations made were based on impressions made on inspection tours and discussions with the mill's technical staff.

Due to a lack of adequate testing facilities locally, to perform standardized tests for physical, milling, and baking characteristics of the wheat blends, duplicate samples of the HRW to SRW blends used for the local evaluation, were sent to Kansas State University (KSU) for further study. Due to the inordinate delay in transmittal of the samples, full details of the study done at KSU could not be incorporated into the report done in November 1989 (KSU Report No. 115).

SECTION II

DESCRIPTION OF WHEAT RECEIVING, CLEANING, AND TEMPERING SYSTEM

La Minoterie D'Haiti has a total wheat storage capacity of 36,000 short tons (st). Silos connected to the mill can hold 15,195 st. The flat storage can hold 10,000 st and the national grain storage facility, CNSG, can hold 11,640 st.

The pneumatic wheat unloading system at the wharf has a capacity of 160 metric tons/hour (mt/hr). At present, due to a lack of maintenance, the unloading capacity has dropped to almost half the original capacity.

The cleaning house has 10 holding bins of 67.5 st capacity each. Out of these 10 bins, bins #9, #7, #3, and #1 are used for holding dirty wheat. Bins #10, #8, #6, #5, #4, and #2, with a total capacity of 298.26 st, are used as first temper bins. The cleaning section also houses 20 more bins, bin #11, to bin #30, with a capacity of 17.5 st each. Six smaller bins, bin #31 to #36, with a total capacity of 50 st, are used as mill mix bins.

Even though it was designed to have dosing feeders under all holding bins, as per the cleaning house renovation program, only four bins, #9, #7, #3, and #1, were fitted with dosing feeders. It was also reported that none of the bins were designed to be "FIFO" bins and actually work as "last in first out". This aggravates the blending situation. Consequently, the mill's staff has been using the four bins equipped with dosing feeders as a nest and have been trying to draw from the four bins at the same time to minimize the segregation of wheat. This arrangement works fine as long as 100 percent of one variety of wheat is used. If two or more varieties of wheat were blended, then the second and third variety would go into the bins without any dosing feeders. Because of these difficulties, the millers, through trial and error, can only achieve approximate blending ratios. It is also desirable to temper different varieties of wheat separately to different levels and conditions that are optimum for the variety and for the conditions under which it is received and then blend the varieties after their equilibrium moisture conditions are reached.

On the other hand, the second variety could be blended from one of the four holding bins with a dosing feeder, with the first variety feeding from the other three dosing feeders. Such an arrangement would require the blend be made before cleaning and tempering. Because of their different physical and structural nature, blending SRW wheats with HRW wheats before tempering, and then tempering the mix, creates a different set of problems. This brings out the inadequacies in the cleaning house system at La Minoterie D'Haiti.

In Appendix I, a typical feeder installation schematic diagram is explained. This is one of many possible installation schemes. Choice of feeders range from conventional dosing feeders to inverter controlled, remote operated screw conveyor feeders. Various aspects discussed earlier underline the importance of having a comprehensive feeder system (that can service the dirty wheat holding bins, temper bins, as well as the mill mix bins) installed in order to insure accurate and consistent blending of the varieties necessary to produce consistent quality flour.

TABLE 1

PHYSICAL MILLING AND BAKING CHARACTERISTICS OF
HRW AND SRW WHEAT BLENDS - LA MINOTERIE D'HAITI

PHYSICAL CHARACTERISTICS

Wheat Blend HRW to SRW		Test Wt lbs/bu	Thou Ker Grams Wt	Pearling Value Percent	Wheat over 7	Size over 9	Test in Percent over 12
100	0	58.32	28.71	12.7	59.8	39.05	1.15
90	10	58.75	28.49	12.2	62.5	36.3	1.2
87	13	58.3	28.05	11.9	62.25	36.4	1.35
85	15	58.67	28.39	12.1	62.25	36.55	1.2
80	20	58.76	28.43	11.8	62.95	36.75	0.3

MILLING CHARACTERISTICS

Wheat Blend HRW to SRW		Extract Rate	Ash Percent	Protein Percent	Wheat Size Test --- Percent Theoretical Yield
100	0	67.9	0.46	11.7	75.92
90	10	68.6	0.44	11.5	76.05
87	13	67.9	0.43	11.3	76.03
85	15	68.3	0.43	11.3	76.04
80	20	67.8	0.43	11.1	76.04

BAKING CHARACTERISTICS AND PHYSICAL DOUGH TESTING

Wheat Blends HRW to SRW		Mix Time Minutes	Absorption C.C.	Loaf Volume C.C.	W x 1000 ergs
100	0	4.3	65	990	329
90	10	4.3	64	975	337
87	13	4.3	63	957	312
85	15	4.3	63	963	291
80	20	4.1	62	935	274

SECTION III

BLENDING STUDY

During the visit, before reaching a decision, the blending ratios to be considered were discussed extensively with the chief miller, Mr. Lionel Pedriel, and the deputy chief miller, Mr. Raoul Perpignan. It was decided to try Soft Red Winter wheat to Hard Red Winter wheat blending ratios of 10:90, 13:87, 15:85, and 20:80. This decision is also supported by an earlier study by Professor J.G. Ponte, Jr., et al. on Chinese soft wheat blends with HRW wheats, and a 1985 International Grains Program (IGP) report on Physical Dough and Baking Tests on HRW and SRW Wheats.

Since the SRW wheats need less temper moisture and less tempering time compared to HRW wheats, it would be appropriate to clean and temper them separately and then blend the wheats to the ratio. Unfortunately, the existing facilities in the cleaning house do not have the capability to do so accurately. So it was decided to use the composite blend of 100 percent HRW wheats which had been tempered to 14.5 percent moisture and blend it with specific amounts of SRW wheat with "as is" moisture in the laboratory and prepare SRW:HRW blending samples of 10:90, 13:87, 15:85, and 20:80 ratios, respectively. Duplicate samples were also prepared and sent to KSU for full evaluation.

Blending samples were ground on a Chopin experimental mill. The flour from each sample was baked experimentally to evaluate the best blending ratio. The aim was to select the maximum blending ratio possible within the limits of acceptable bread quality. From visual and physical characteristics inspection, it was found that with a 20 percent blend of SRW wheat, there was a decrease in loaf volume. While maintaining all other characteristics, a 15 percent blend of SRW wheat showed only a marginal difference in volume compared to a 10 percent SRW wheat blend which was found to be acceptable in the market earlier.

On the basis of the rudimentary tests done locally, it was decided that a starting blend ratio of 15 percent SRW to 85 percent HRW wheat should be tried. Also, the ratio could be increased or decreased within the range of 20 to 10 percent of the SRW wheat as conditions dictate in the future.

After samples were received at KSU in December 1989, they were analyzed for physical, milling, and baking characteristics of the wheat blends. Salient features of the results are shown in Table 1 and Appendix II.

It was clear from the physical characteristics of the blends tested that there was little difference in test weight and 1,000 kernel weight between the control (100 percent HRW) and the blends of 90:1, 87:13, 85:15, and 80:20 of HRW:SRW. However, 100 percent of the HRW sample recorded the highest pearling value because HRW is harder than SRW wheats. From the wheat size test, it is evident that the SRW wheat had more plump kernels than the HRW wheat that was blended together.

Regarding the milling characteristics of the control and the wheat blends, the following conclusions were made based on the results. The variation in the

straight grade flow extraction rates, obtained for the control and blends, was negligible. Flour from the control sample, 100 percent HRW, recorded the highest protein and ash values. Obviously, the higher percentage of plump kernels in SRW blends contributed to the lower ash value of flour obtained from the blends.

From the physical dough tests and baking tests performed, it was very clear that the control, 100 HRW, is superior to the blended samples in dough strength reflected in the higher mixing time, higher absorption, and w value from the Alveograph experiment. But, at the same time, it could be observed that up to the blending ratio of 85:15 of HRW:SRW, mixing time (4.3 minutes), absorption (63 c.c.), w value of the Alveograph (291 x 10^3 ergs) and the loaf volume (963 c.c.) are comparable to the control sample. But the values for the 80:20 blend have decreased dramatically from those of the 85:15 blend.

The results obtained from this blending study (KSU Grain Science Department) definitely support the decision taken in October 1989 to start SRW blending into HRW wheat at 15 percent at La Minoterie D'Haiti.

However, due to the inadequacies existing at the blending facilities at Minoterie, the extremely small size of the samples obtained, the samples obtained were not enough to conduct either more extensive investigation or even duplicate the tests for repeatability. The extraordinary delay in transmittal of the samples to KSU did not help either. This study should only be taken as indicative of what one can expect from a more elaborate study with repeatable results (larger samples needed).

SECTION IV

COMPLIANCE WITH "MEMORANDUM OF UNDERSTANDING"

In order to comply with the Memorandum of Understanding (MOU), an inspection of the facilities was conducted in the presence of the mill's mechanical engineer with the specific aim of verifying the correctional program initiated by the management of La Minoterie D'Haiti.

It was evident from the "Schedule of Correction of Operational Problems" charts included in Appendix III that an effort was being made towards that goal. From the initial and subsequent inspections, it was evident from a major part of the list of completed jobs presented that a welcome and long needed correctional program to reduce dust flying out of the machines in the cleaning house and mill had been initiated. This will go a long way in making the work place a safe environment. But the sources of the unsanitary conditions have not yet been eliminated. For example, the second filter dust collector and some other needed machines are still not operating. Unless these sources of dust production and dispersion into the mill are eliminated, the real benefits of the correctional work being done at present will not be realized. Installation of guards for the man lift wells and maintenance of the man lift are also still on the future correction list.

Due to the short duration of the visit, it was difficult to gather much supporting evidence in writing. But, it appears that some reductions have been made in the temporary work force. The situation regarding the existing/new contracts for competitive pricing of bags could not be verified due to a shortage of time.

The director general of La Minoterie D'Haiti stated that a French consulting team was at the mill during the week of October 9, 1989 to survey the power factor situation and submit a proposal/quotation for correction of the power factor.

The project for repairing the pneumatic system and its upkeep has not been initiated yet. None of the suggested repair jobs have been attempted and it was found that required materials for beginning the repair also have not yet been purchased.

Even though the wharf scale and dump scale for Son du blé have not been repaired, new platform scales were in place at the Son du blé packer. Mechanical counters were also installed on the belt conveyors, which will help keep count of the number of bags packed at any given time during the day. But it was found that the belt conveyors do not always work and the counters are bypassed. It was suggested that additional mechanical counters be installed on each individual packer.

SECTION V

CONCLUSIONS AND RECOMMENDATIONS

During the October 1989 visit, in consultation with the director general and the millers, it was concluded that 15 percent SRW wheat could be blended with 85 HRW wheat to produce an acceptable quality of flour. This blending ratio could be increased or decreased to suit specific conditions.

The duplicate samples were sent to KSU/Department of Grain Science for evaluation. From the analysis of the physical, milling and baking characteristics of the samples, it can be concluded that 100 percent HRW is superior to the blends for making flour suitable for bread baking. However, up to 85:15 blending ratio of HRW to SRW wheats, flour can be produced with quality and extraction rates comparable to 100 percent HRW and suitable for baking bread of acceptable quality. There was a sudden decrease in the quality parameters at the blending ratio of 80:20. This study definitely supported the decision taken during the visit to La Minoterie D'Haiti in October 1989.

SECTION VI

REFERENCES

1. He, H., and J. Ponte, Jr. Evaluation of Chinese and U.S. Wheats and Their Blending for Bread Making. Published in Cereal Foods World, Vol. 33, No. 6, pp. 506-510.

2. Physical Dough and Baking Tests on Hard Red Winter and Soft Red Winter Wheats. Kansas State University, International Grains Program, Department of Grain Science and Industry, May 3, 1985.

SECTION VII

ACKNOWLEDGMENTS

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Mr. Gabriel Verret, Officer
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La Minoterie D'Haiti

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Mr. Maxime Antoine, Administrative Director
Mr. Charles-Irene Altidor, Financial Director
Mr. Saint Louis Vincent, Mechanical Maintenance Head
Mr. Lionel Perdriel, Head Miller
1Mr. Raoul Perpignan, Deputy Chief Miller
Mr. Justin Najac, Quality Control Head
Mr. Daniel Joseph, Head of Electrical Maintenance
Mr. Henry Charles, Technical Advisor
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Kansas State University, Department of Grain Science and Industry

Mr. Bob Bequette, Analytical Laboratory
Mr. Ron Stevenson, Experimental Milling Laboratory
Mr. Mark Engelin, Baking Science Laboratory

APPENDIX I

FEEDER SYSTEM DIAGRAM AND SPECIFICATIONS FOR WHEAT BLENDING
(January 1990)

INSTALLATION OF DOSING FEEDERS UNDER THE TEMPER BINS AT LA MINOTERIE
(Given to La Minoterie's management on January 19, 1990)

1. Bins #10, #8, #6, #5, #4, and #2 have a combined capacity of 398.26 st. These bins require six dosing feeders.

2. Smaller bins #30, #29, #28, and #27 could be grouped and connected to one feeder. These bins have a combined capacity of 70.0 st.

3. Also, smaller bins #26, #25, #24, and #23 could be grouped and connected to one feeder. These bins have a combined capacity of 70.0 st.

4. Minimum of eight dosing feeders will be needed to improve the blending capability of the cleaning house.

5. Bins #10, #8, #4, and #2 could be used for one variety of wheat. Bins #5 and #6 could be used for another variety. Smaller bins #30, #29, #28, #27, #26, #25, #24, and #23 could be used for yet another type of wheat.

6. All the above bins should be fitted with gates. Choice of manual, pneumatic, and electrical gates is available.

7. After dosing, wheat from bins #30, #29, #28, #27, #26, #25, #24, and #23, will be collected from the feeders by collection conveyors.

8. The new Merchen Feeders already purchased and kept in the storeroom could be very useful in this application. It is better to temper the different varieties of wheat to different temper moistures as practically required, and allow the tempered wheat to reach equilibrium moistures separately. These tempered wheats could then be blended through the dosing feeders. When this project is implemented, La Minoterie will have a temper bin capacity of 500 st with eight dosing feeders, and will be able to blend three different types of wheat into any mill mix.

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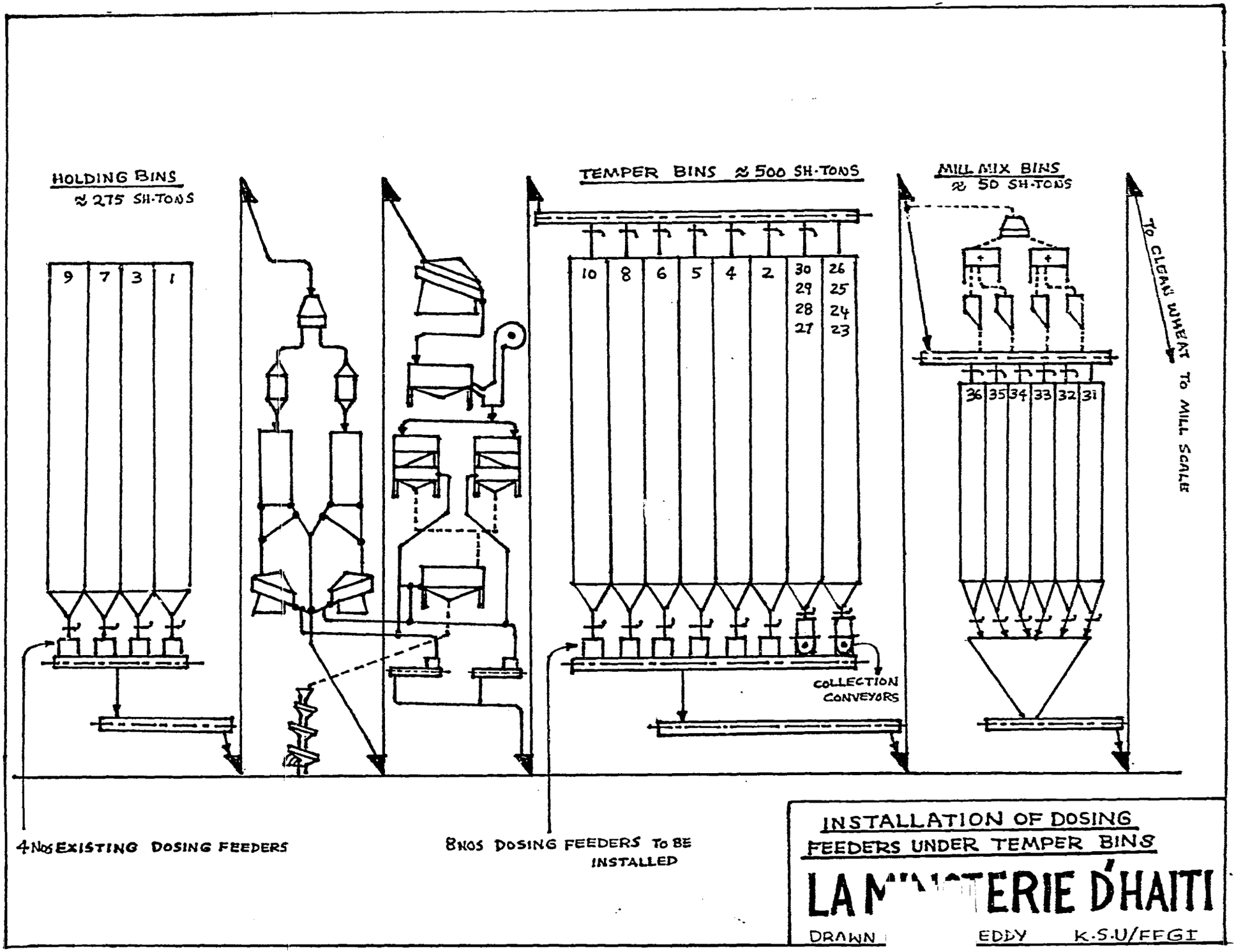

HOLDING BINS
≈ 275 SH-TONS
9
7
3
1
TEMPER BINS ≈ 500 SH-TONS
10
8
6
5
4
2
30
29
28
27
26
25
24
23
COLLECTION CONVEYORS
MILL MIX BINS
≈ 50 SH-TONS
36
35
34
33
32
31
TO CLEAN WHEAT
TO MILL SCALE
4 Nos EXISTING DOSING FEEDERS
8 NOS DOSING FEEDERS TO BE INSTALLED
INSTALLATION OF DOSING FEEDERS UNDER TEMPER BINS
LA M TERIE D'HAITI
DRAWN EDDY K.S.U/FFGI

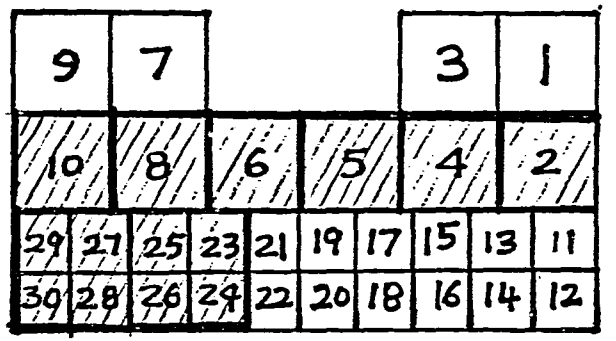
CAPACITY OF HOLDING BINS (DIRTY WHEAT) #9,7,3,1 = 4 × 67.46 = 269.84 SHORT TONS.

CAPACITY OF TEMPERING BINS
#10, 8, 6, 5, 4, 2.
4 × 67.46 = 269.84 (#10,8,4,2)
2 × 63.71 = 127.42 (#6,5)
398.26 SHORT TONS.

ALSO
20 BINS (#30 ---- 11)
17.5 Short tons each
= 17.5 × 20 = 350 Short tons

#29, 27, 30, 28
COULD GROUP TOGETHER TO ONE FEEDER

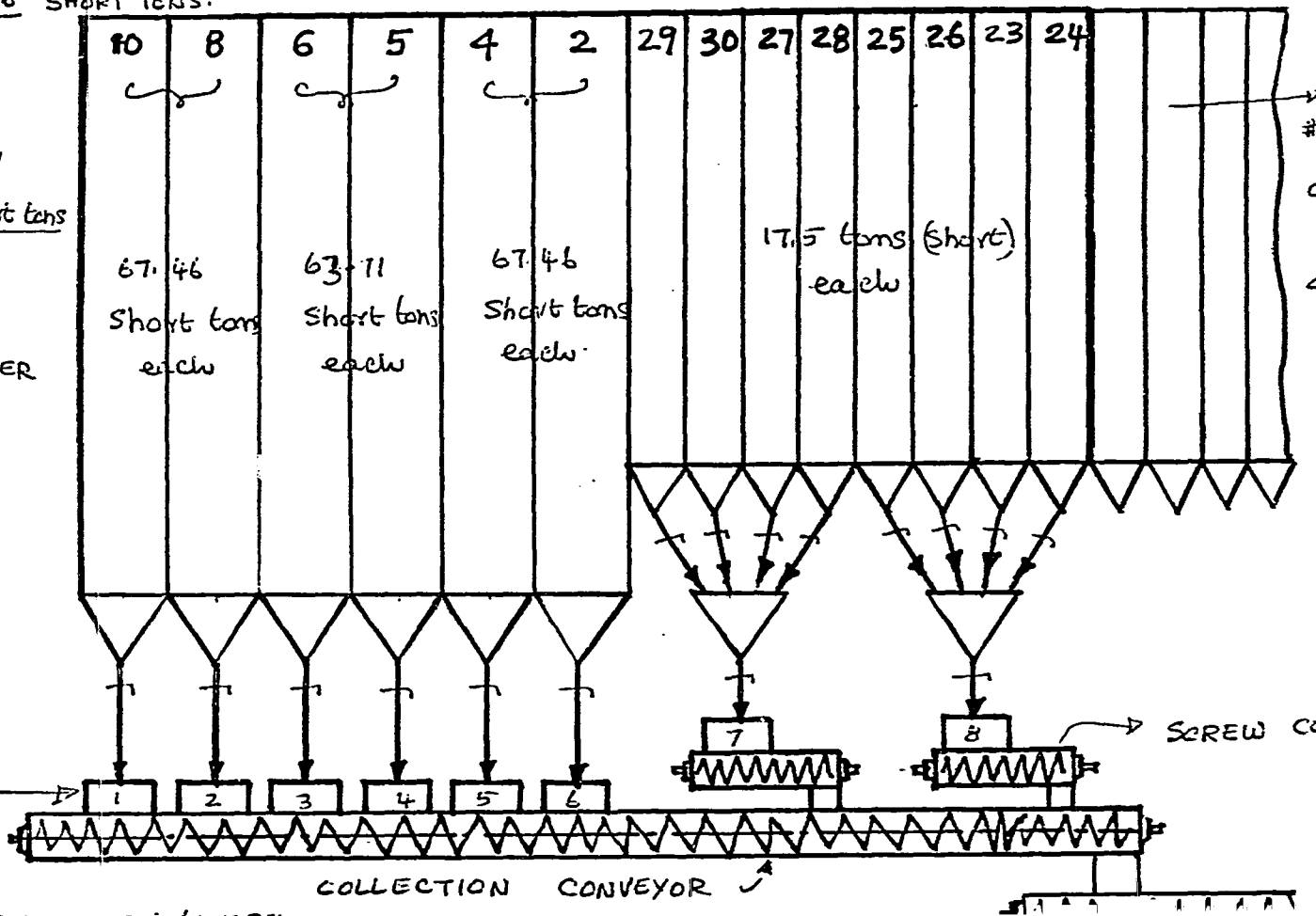
25, 23, 26, 24
GROUP TOGETHER to ONE FEEDER



9,7,3,1 DIRTY WHEAT HOLDING BINS

10,8,6,5,4,2 TEMPER BINS

29 ---- 11
30 ---- 12 } TEMPER BINS



DRAWN BY: P.V.REDDY

APPENDIX II

WHEAT BLENDING STUDY
KANSAS STATE UNIVERSITY
FOOD AND FEED GRAINS INSTITUTE

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WHEAT BLENDING STUDY
PHYSICAL, MILLING AND BAKING CHARACTERISTICS OF
HARD RED WINTER AND SOFT RED WINTER WHEAT BLENDS

Kansas State University
Food and Feed Grains Institute
Department of Grain Science and Industry
January 1990

Background

One-thousand gram samples of 100 percent HRW and four different blends of 90:10, 87:13, 85:15, and 80:20 of HRW to SRW wheats were sent from La Minoterie D'Haiti for evaluation. Due to the very small sample size obtained, it was decided to perform only a few selected tests.

Methods

The following tests were performed:

Physical characteristics:	Test weight, 1,000 kernel weight wheat size test
Milling characteristics:	Experimental milling on Quadrumat Senior, Ash, Protein
Physical dough testing:	Mixograph, Alveograph
Baking characteristics:	Pup loaf baking

Test weight. Test weight is the weight per Winchester bushel with the weight expressed to the nearest tenth of a pound. Determination was made as described in Circular No. 921 issued by the United States Department of Agriculture.

One-thousand kernel weight. The weight in grams of 1,000 kernels of wheat was determined with an electronic seed counter using a 40 gram sample from which all foreign material and broken kernels have been removed.

Pearling value. Twenty grams of wheat with all foreign materials and broken kernels removed is retained for 1 minute in a "Strong Scott Laboratory Barley Pearler" equipped with No. 30 grit stone and a 10 mesh screen made of wire 0.041 inches in diameter (Tyler Code "Fijor"). Pearling value is percent of original sample remaining over a 20 mesh wire after pearling.

Wheat size test. Two-hundred grams of wheat are placed on the top sieve of a stack of three Tyler standard sieves (No. 7, 9, 12). The stack of sieves is placed in a Ro-Tap sifter and sifted for 60 seconds. The percentage remaining on each sieve is then determined, multiplied by factors of 78, 73, and 67, respectively, and summed to obtain a single number denoting the theoretical flour yield.

Experimental milling. Experimental milling was done on a "Quadrumat Senior"

table top experimental mill. A 900 gram sample was used for each blend. Due to the very small size of the sample received, duplicating could not be done.

Mixograph

The 10 gram mixograph is a miniature high speed recording dough mixer that can be used to determine mixing requirement, mixing tolerance, and water absorption of wheat flours. The mixing effect is obtained by the result of the dough being stretched around three or four fixed pins in the mixing bowl as the rotating mixing head with four vertical pins moves in a planetary motion. As the flour takes up water and the gluten starts to develop, there is a gradual increase in the amount of force required to move the pins through the dough. The increased dough resistance causes a swinging action to be imparted on the bowl which is in the center of a lever system. The swinging action is measured and recorded by a pen on the chart paper moving at a constant rate.

The following terms are used to describe the mixograph:

A - Dough Development

B - Mixing Stability

C - Peak Mixing Time (4 minutes)

Absorption. The percentage of water required to produce an optimum mixogram. The water absorption (with flours scaled at a constant of 14 percent moisture basis) increases with increasing flour protein. An optimum absorption is shown in the curve above. Too much water would produce a curve that dips during the development stage whereas too little water would cause the curve to be very wide.

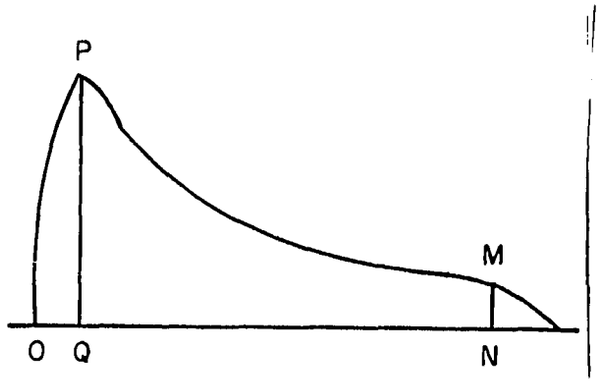
Mixing time. The time required for the dough to reach its full development. This time can be determined from the intersection of two lines drawn through the center of both sides of the curve. The distance from the start of the curve to the intersection of the two lines is the optimum mixing time. This may also be known as the peak time.

Mixing tolerance. The ability of the dough to withstand over mixing. A dough with low mixing tolerance will produce a curve with a very sharp peak and an immediate decrease in the width and height of the curve thereafter. A dough with good mixing tolerance will produce a curve with a gradual peak that maintains its width and height after the optimum mixing time.

Alveograph

The Alveograph or Chopin Extensimeter is an instrument designed to measure the extensibility and resistance to expansion of a thin sheet of dough. Basically,

it measures the pressure attained by a carefully controlled flow of air against a dough sheet until the extended dough membrane bursts. The thin dough sheet is securely held between two metal plates, the upper one having a circular hole through which the expanding dough bubble can rise, while the lower plate is provided with a small air valve. The air valve leads to a small air chamber beneath the bottom plate which is connected to a large burette which provides the air pressure by having water supply by an elevated water tank rise in it and displace the air. The air chamber is additionally connected to a recording manometer which records the air pressure within the dough bubble against time. The entire operation is carried out at a controlled temperature of 77°F (25°C).



A typical curve obtained on the Alveograph shows resistance of the dough to expansion is greatest at the outset of the test, resulting in a steep vertical rise of the curve to an optimum point P. The gluten strands begin to stretch and slide past each other with greater ease and results in a rapid decline in the curve, followed by a more gradual decrease until the dough bubble bursts at point M. The height of PQ is indicative of the dough's tensile strength or stability in its initial stage. The total volume attained by the dough bubble may be read on the burette since its water level corresponds to the volume of air displaced from it to inflate the dough bubble. The total area under the curve may also be measured by means of a planimeter. The volume of the bubble as determined by either method is a good indication of the baking strength of the flour. The extensibility of the dough is shown by the line QN. Hence, the curve of the Chopin Alveograph provides a fairly complete picture of dough characteristics.[1]

TEST BAKING PROCEDURE FOR PUP LOAVES

Formula		Weight
180 min fermentation	Flour (14 percent M.B.)	100
	NFDM	4
	Shortening	3
	Salt	1.5
	Sucrose	6
	Malt	opt
	Potassium Bromate	opt
	Compressed Yeast	2
	Water	opt

[1]Reference: Pyler, E.J., Baking Sci. and Tech.

Procedure

1. Add dry ingredients to lightly greased mixing bowl. If using instant yeast, add and immediately stir well.

2. Add sugar/salt solution, yeast suspension (or water), and remaining water (including bromate solution).

3. Mix to optimum consistency (minimum mobility) as determined by smoothness and stretchability (film forming ability) of dough. Note time.

4. Remove dough from mixing bowl. Using approximately four stretching manipulations, form a smooth ball.

5. Place dough ball in lightly greased, suitable bowl (such as Stainless Steel, 45 mm diameter x 63 mm high). Cover with plexiglass and place in fermentation cabinet at 30°NC (86°NF). and 85-90 percent RH.

6. After 105 minutes, measure and record height of dough ball (distance from top of bowl).

7. First punch: sheet through rolls set with 3/16" (4.8 mm) gap.

8. Fold dough strip in half twice so that outside skin of fermented ball remains outermost.

9. Return to covered bowl and cabinet for 50 minutes.

10. Second punch: sheet through rolls set with 3/16" (4.8 mm) gap. This results in cross-sheeting the dough.

11. Fold twice as before, ensuring that previous outer skin remains outermost.

12. Return to covered bowl and cabinet for 25 minutes.

13. Sheet through rolls set at 5/16" (7.9 mm) gap,1 again cross-sheeting the dough. Roll into a tight cylinder ensuring that outside layer is maintained. Pinch ends to seal.

14. Place roll in lightly greased pan (140 x 80 x 60 mm). One long side of the pan should be greased only on the bottom half. Place dough such that the seam is centered on the bottom, pointing toward the fully greased side of the pan. Place paper number of the top ends of the dough for loaf identification.

15. Proof 55 minutes and measure to nearest mm OR proof to constant height of 76 mm and note time.

16. Bake 24 minutes, 419°NF (215°NC).

17. Remove from pan. Weigh (+ 0.1 g) and measure volume by dwarf rapeseed displacement immediately.

18. Allow to cool. Cut with sharp serrated knife or with electric knife. Evaluate crust texture and color, crumb texture and color, odor and flavor.

TABLE 1

PHYSICAL MILLING AND BAKING CHARACTERISTICS OF HRW AND SRW WHEAT BLENDS - LA MINOTERIE D'HAITI

PHYSICAL CHARACTERISTICS

Wheat Blend HRW to SRW		Test Wt lbs/bu	Thou Ker Grams Wt	Pearling Value Percent	Wheat over 7	Size over 9	Test in Percent over 12
100	0	58.32	28.71	12.7	59.8	39.05	1.15
90	10	58.75	28.49	12.2	62.5	36.3	1.2
87	13	58.3	28.05	11.9	62.25	36.4	1.35
85	15	58.67	28.39	12.1	62.25	36.55	1.2
80	20	58.76	28.43	11.8	62.95	36.75	0.3

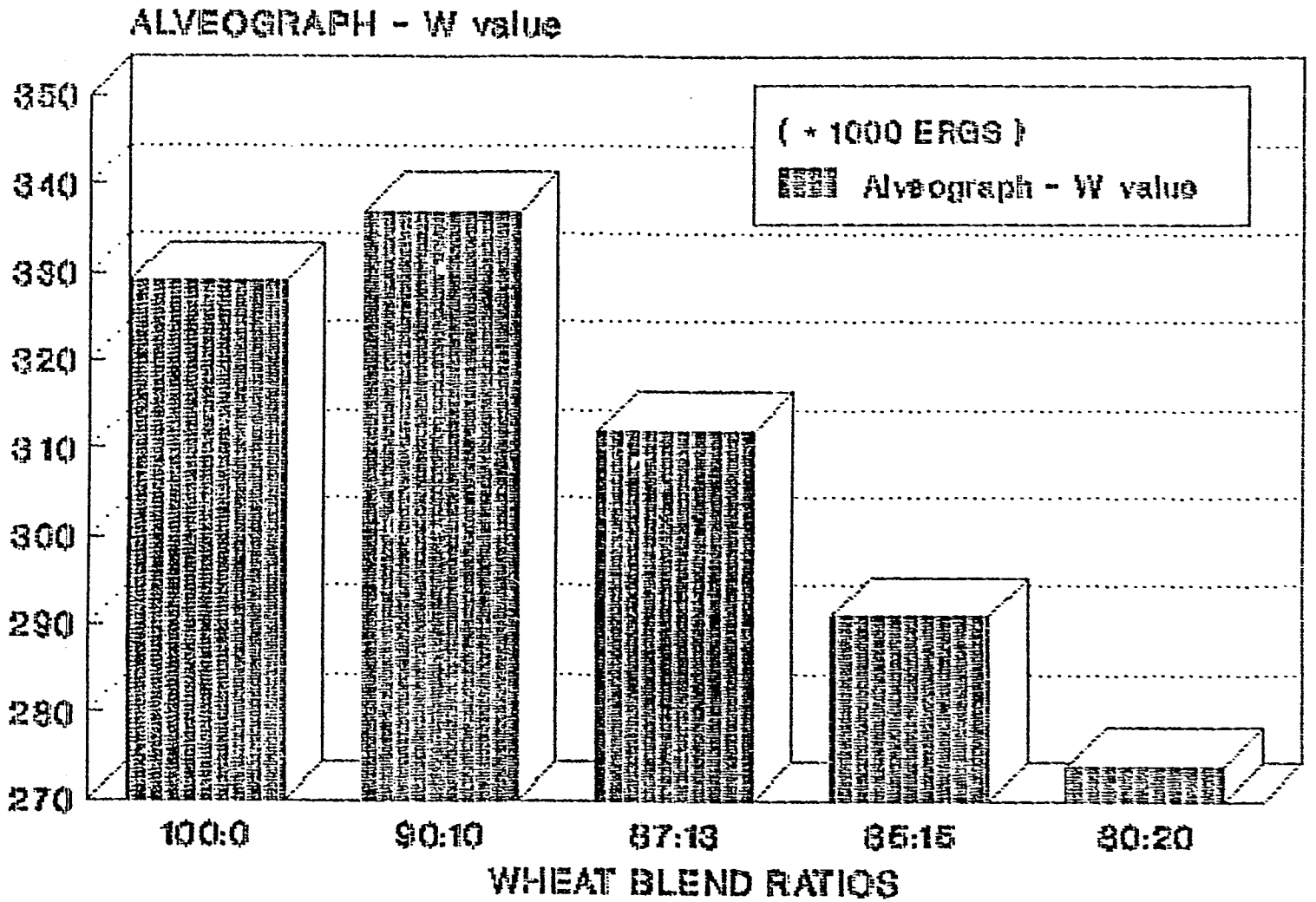
MILLING CHARACTERISTICS

Wheat Blend HRW to SRW		Extract Rate	Ash Percent	Protein Percent	Wheat Size Test --- Percent Theoretical Yield
100	0	67.9	0.46	11.7	75.92
90	10	68.6	0.44	11.5	76.05
87	13	67.9	0.43	11.3	76.03
85	15	68.3	0.43	11.3	76.04
80	20	67.8	0.43	11.1	76.04

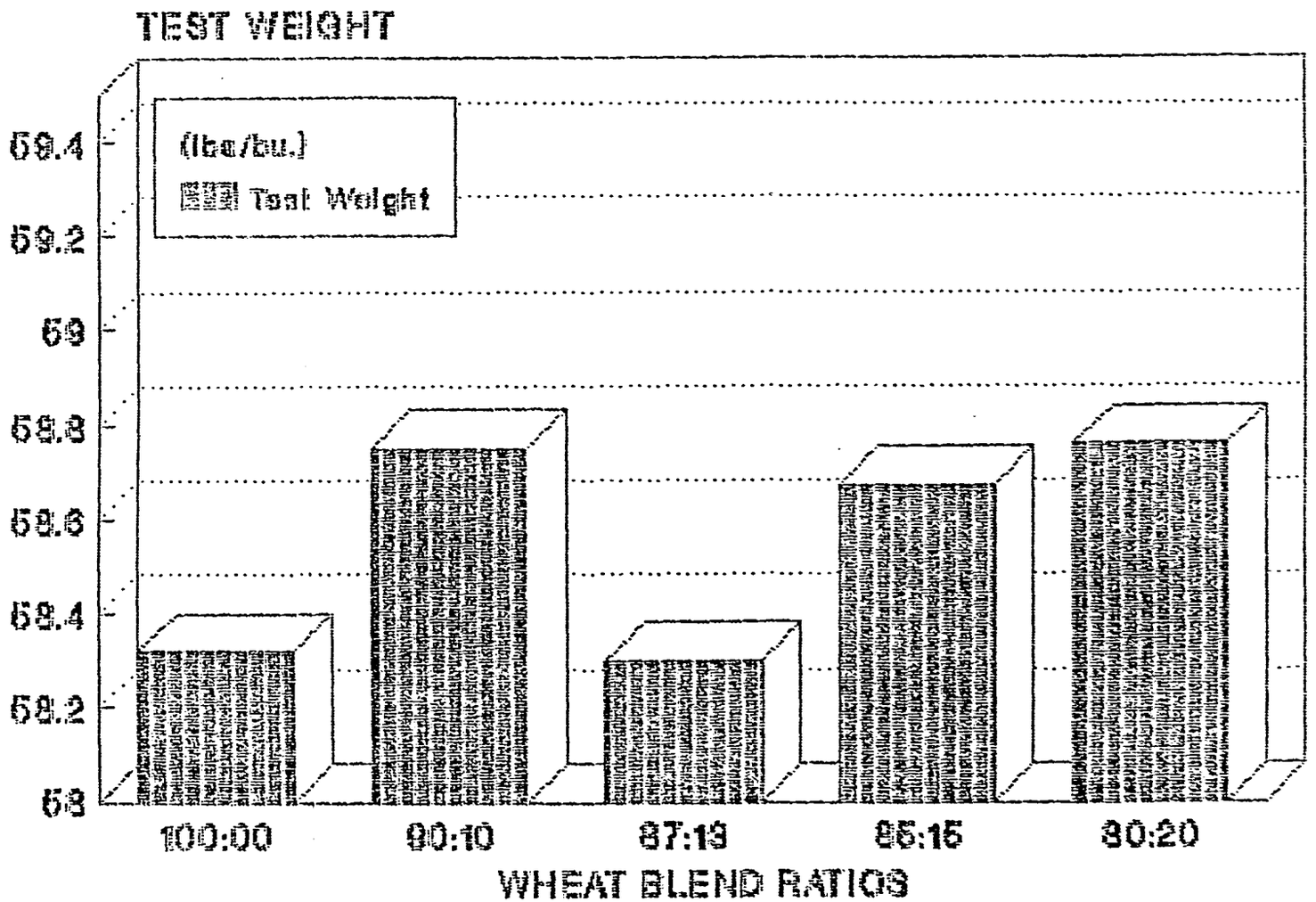
BAKING CHARACTERISTICS AND PHYSICAL DOUGH TESTING

Wheat Blends HRW to SRW		Mix Time Minutes	Absorption C.C.	Loaf Volume C.C.	W x 1000 ergs
100	0	4.3	65	990	329
90	10	4.3	64	975	337
87	13	4.3	63	957	312
85	15	4.3	63	963	291
80	20	4.1	62	935	274

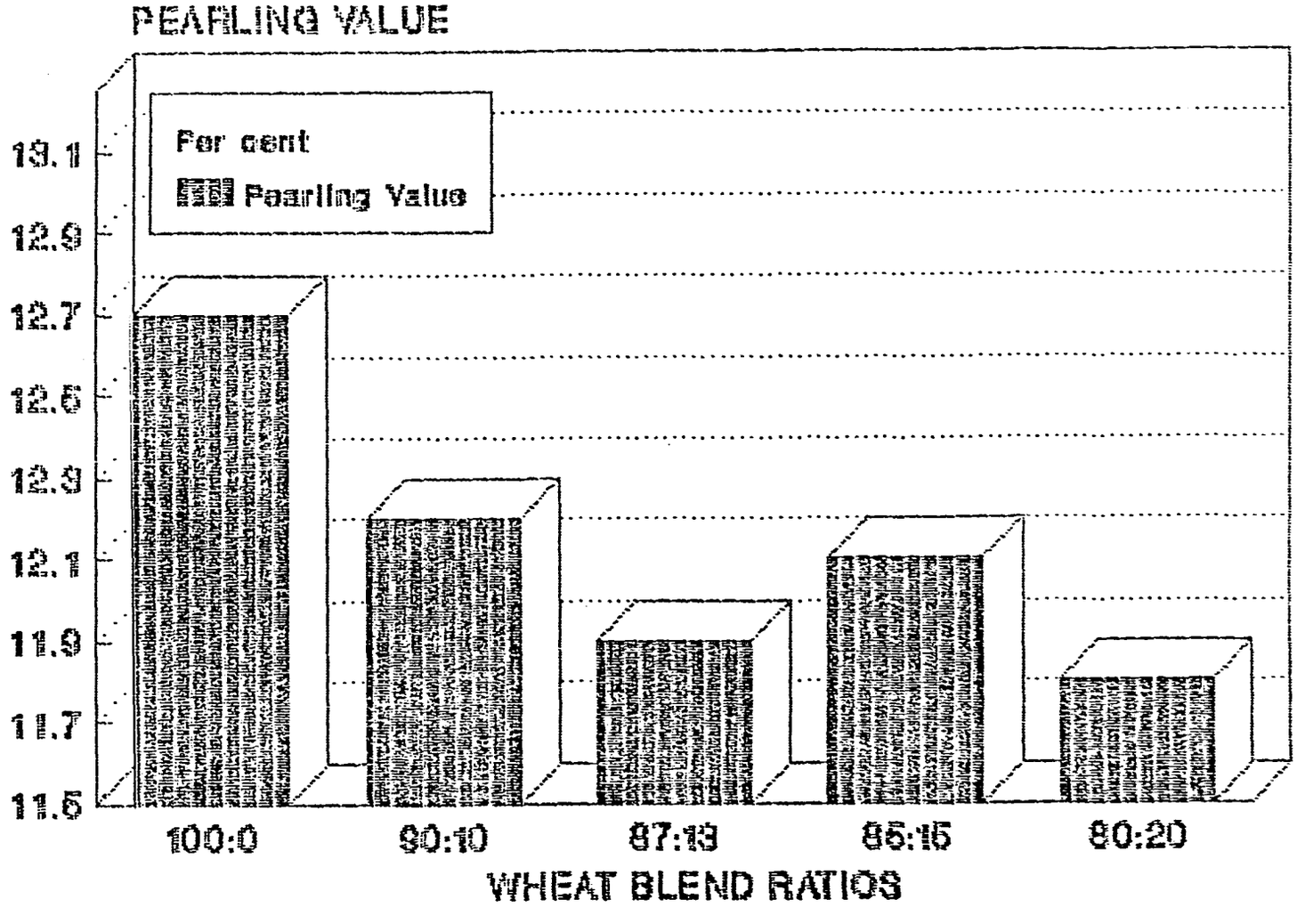
PHYSICAL DOUGH TESTING OF FLOUR
(H.R.W. / S.R.W. Wheat Blends)



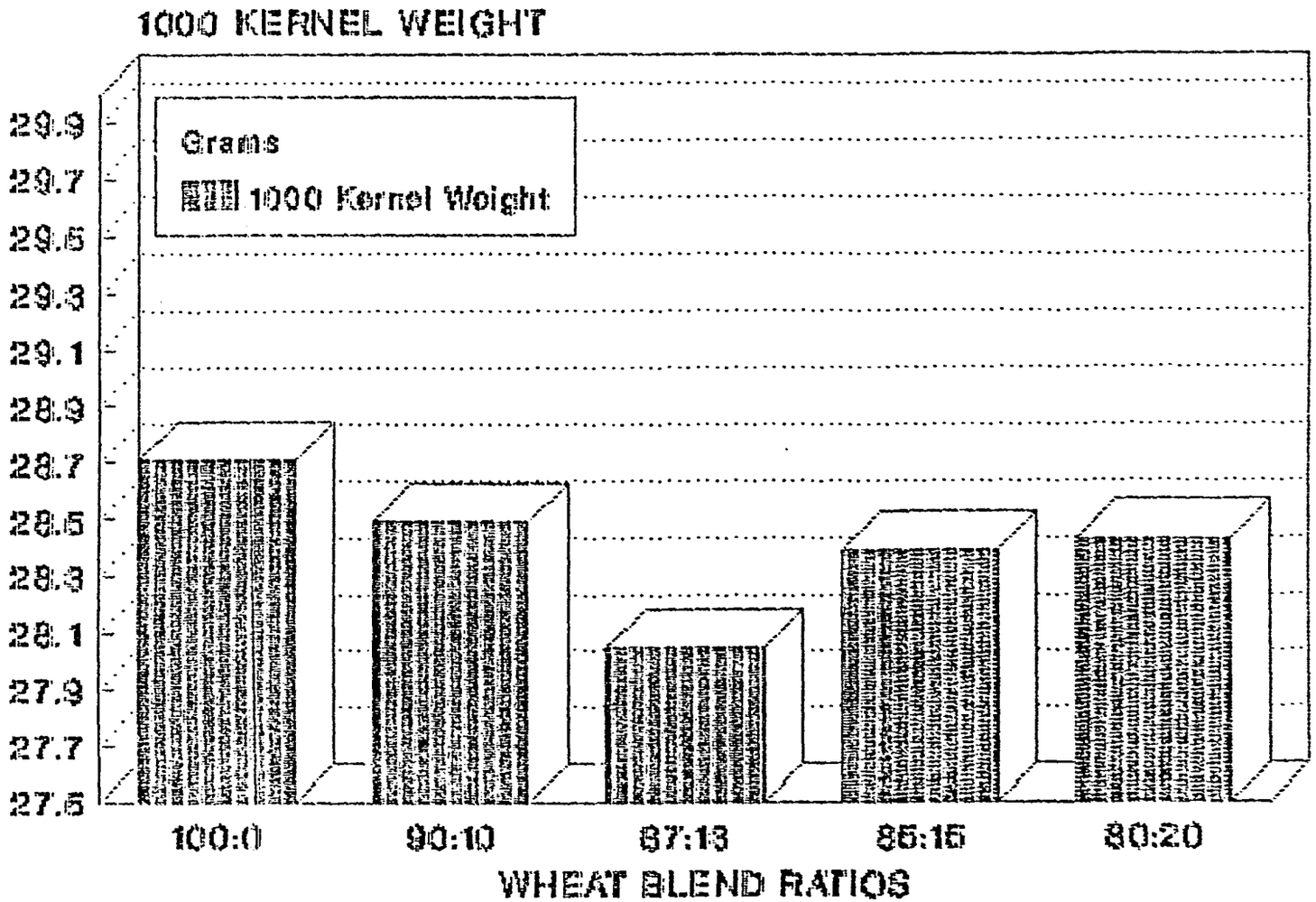
PHYSICAL CHARACTERISTICS OF WHEAT BLENDS
(HARD RED WINTER/SOFT RED WINTER)



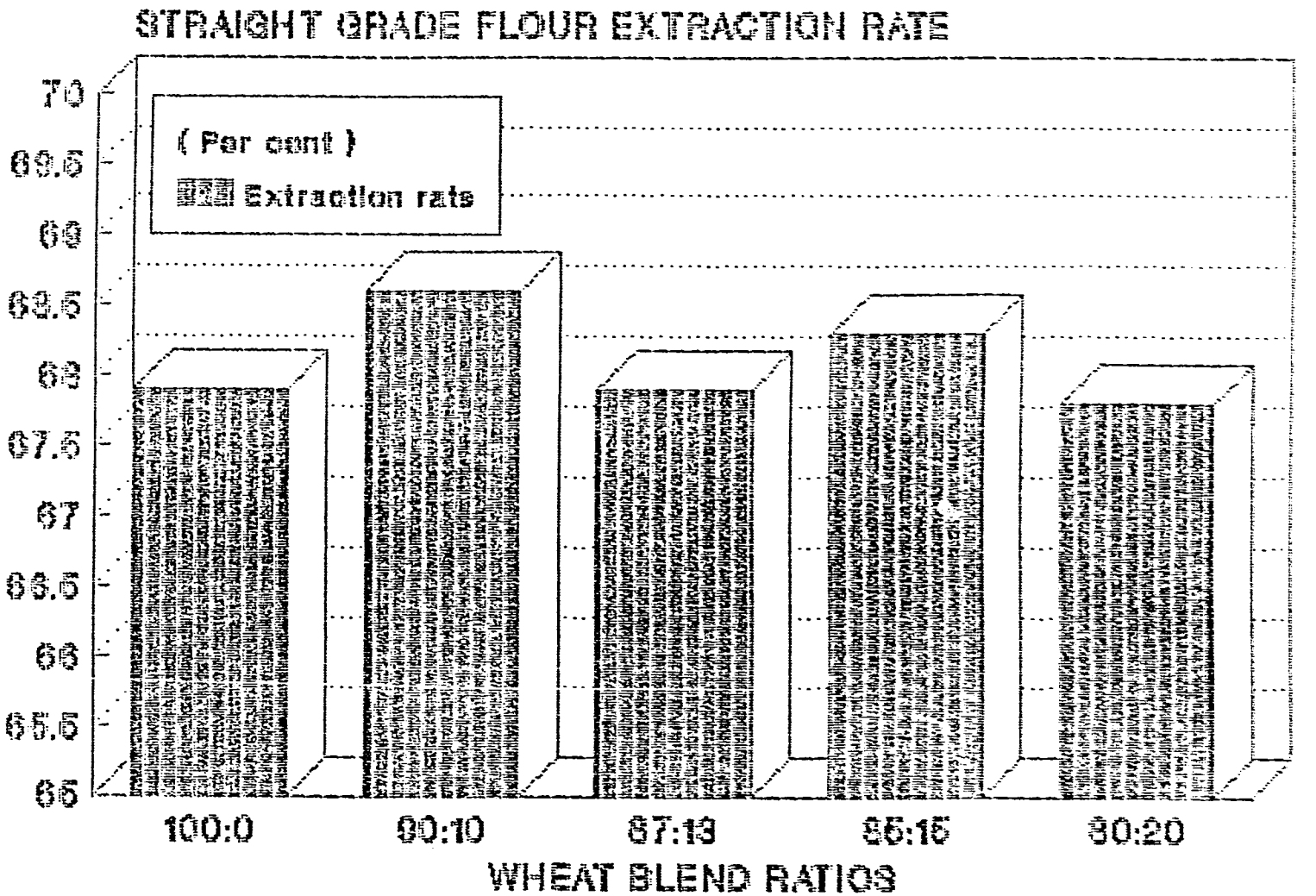
PHYSICAL CHARACTERISTICS OF WHEAT BLENDS
(Hard red winter / Soft red winter)



PHYSICAL CHARACTERISTICS OF WHEAT BLENDS
(Hard red winter / Soft red winter)

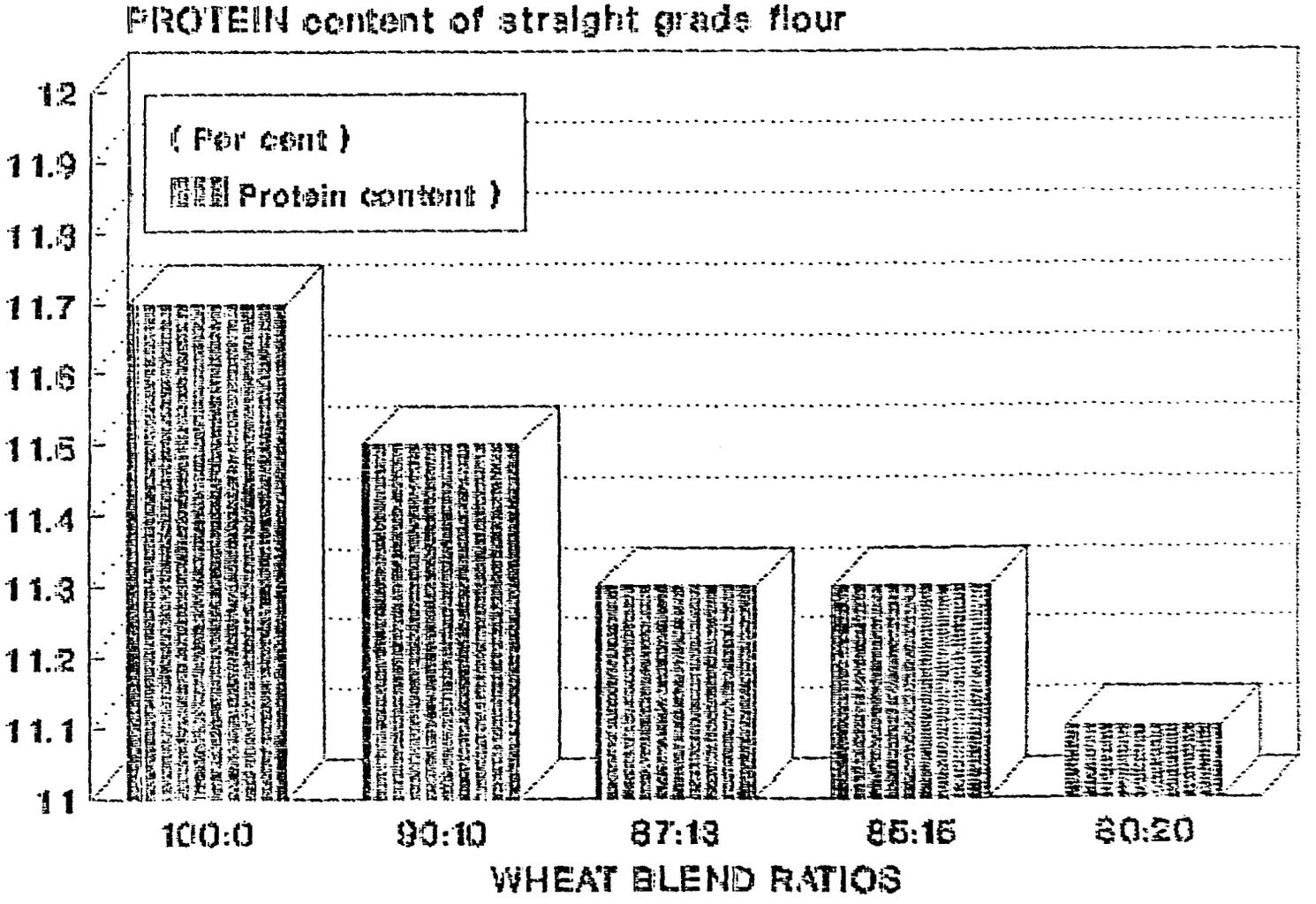


MILLING CHARACTERISTICS OF WHEAT BLENDS
(Hard red winter / Soft red winter)

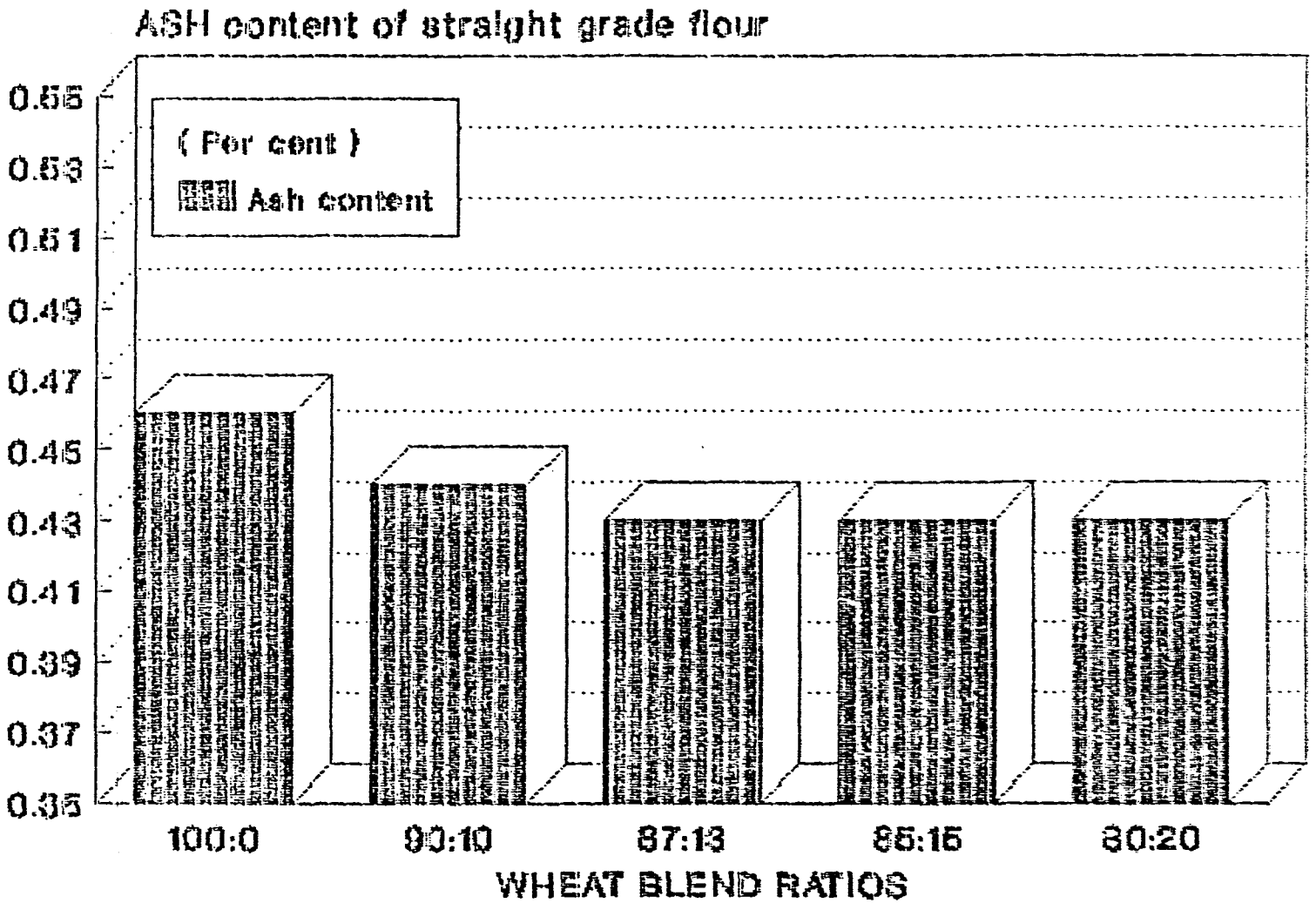


MILLING CHARACTERISTICS OF WHEAT BLENDS

(Hard red winter / Soft red winter)



MILLING CHARACTERISTICS OF WHEAT BLENDS
(Hard red winter / Soft red winter)



CHOPIN ALVEOGRAPH

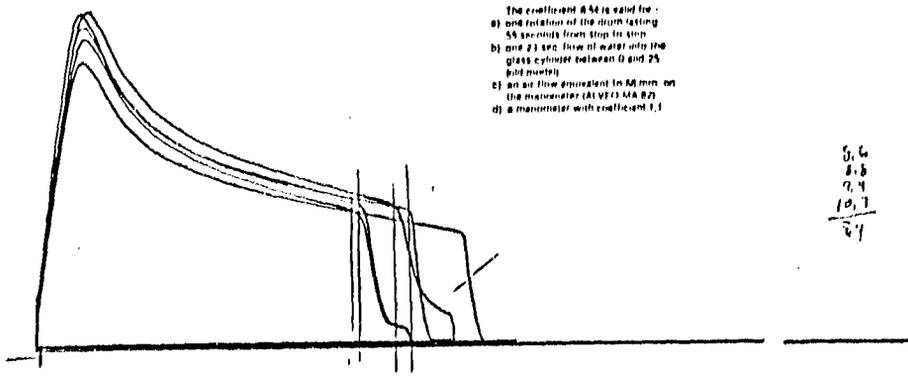
Test N° ..... Date .....

Subject Reddy 100% 0%

Moisture content: % (Water addition ml)
Temperature - Laboratory °C Relative humidity %

W = 6,54 × [S 50,3] = [329] × 10^{-4} joules

The coefficient 6,54 is valid for :
a) one rotation of the drum lasting 55 seconds from stop to stop
b) one 23 sec. flow of water into the glass cylinder between 0 and 25 (old model)
c) an air flow equivalent to 68 mm on the manometer (ALVEO MA 87)
d) a manometer with coefficient 1,1



8,6
8,8
9,4
10,1
9,4

sI cm² = [E] × [R] =

p = [MN] × 1,1 = [ ] m/m

8,5
6,9
9,8
9,4
9,0

P = [H] × 1,1 = [9,9] m/m

sII cm² =

7,1
7,5
8,0
8,4
7,8

L = [ON] m/m

[P 9,9 / L 7,4] = [1,1]

G = [ ]

sIII cm² = [ZN] × [ZF] =
S cm²

CHOPIN ALVEOGRAPH

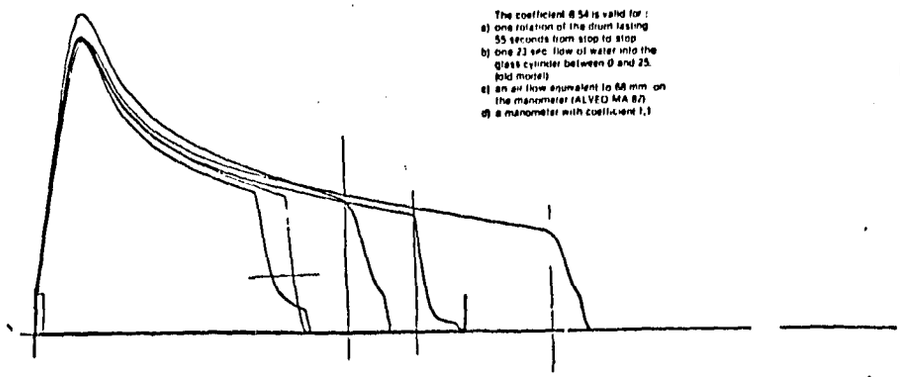
Test N° ..... Date .....

Subject Reddy 90% 10%

Moisture content: % (Water addition ml)
Temperature - Laboratory °C Relative humidity %

W = 6,54 × [S 55,6] = [337] × 10^{-4} joules

The coefficient 6,54 is valid for :
a) one rotation of the drum lasting 55 seconds from stop to stop
b) one 23 sec. flow of water into the glass cylinder between 0 and 25 (old model)
c) an air flow equivalent to 68 mm on the manometer (ALVEO MA 87)
d) a manometer with coefficient 1,1



sI cm² = [E] × [R] =

p = [MN] × 1,1 = [ ] m/m

8
8
8,8

P = [H 8,3] × 1,1 = [9,1] m/m

sII cm² =

9,2
7,7
7,1
8,0

L = [ON] m/m

[P 9,1 / L 11,1] = [0,90]

G = [ ]

sIII cm² = [ZN] × [ZF] =
S cm²

CHOPIN ALVEOGRAPH

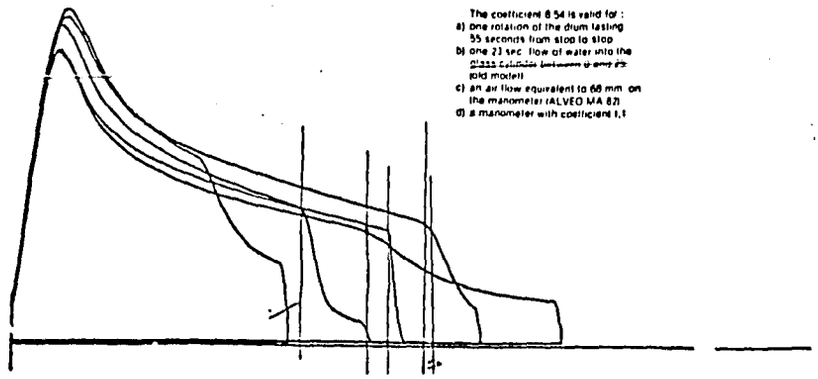
Test N° ..... Date .....

Subject Reddy 87% 13%

Moisture content: % (Water addition ml)
Temperature - Laboratory °C Relative humidity %

W = 6,54 × [S 47,7] = [312] × 10^{-4} joules

The coefficient 6,54 is valid for :
a) one rotation of the drum lasting 55 seconds from stop to stop
b) one 23 sec. flow of water into the glass cylinder between 0 and 25 (old model)
c) an air flow equivalent to 68 mm on the manometer (ALVEO MA 87)
d) a manometer with coefficient 1,1



sI cm² = [E] × [R] =

p = [MN] × 1,1 = [ ] m/m

8,9
8,7
8,0
8,0
8,4

P = [H] × 1,1 = [9,24] m/m

sII cm² =

8,8
7,3
6,5
8,9
7,4

L = [ON] m/m

[P 9,24 / L 9,9] = [0,93]

G = [7,1]

sIII cm² = [ZN] × [ZF] =
S cm²

CHOPIN ALVEOGRAPH

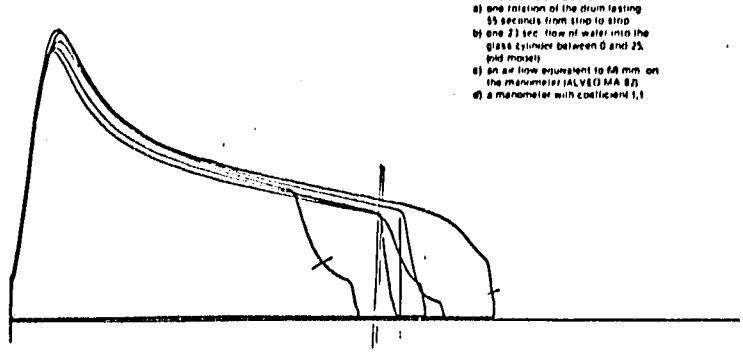
Test N° ..... Date .....

Subject Reddy 85% : 15%

Moisture content % (Water addition ml)
Temperature - Laboratory °C Relative humidity %

W = 0,54 x S 144,5 = 294 x 10^{-4} joules

The coefficient 0,54 is valid for :
a) one rotation of the drum lasting 55 seconds from stop to stop
b) one 23 sec. flow of water into the glass cylinder between 0 and 25. (old model)
c) an air flow equivalent to 68 mm. on the manometer (ALVEO MA 82)
d) a manometer with coefficient 1,1



sI cm² = E x H =

p = MN x 1,1 = m/m

P = H 7,5 x 1,1 = 8,3 m/m

sII cm² =

SC'

7,4
6,8
6,5
6,2

L = ON m/m

P 8,3 / L 10,2 = ,81

G =

sIII cm² = ZN x ZF =

S cm²

CHOPIN ALVEOGRAPH

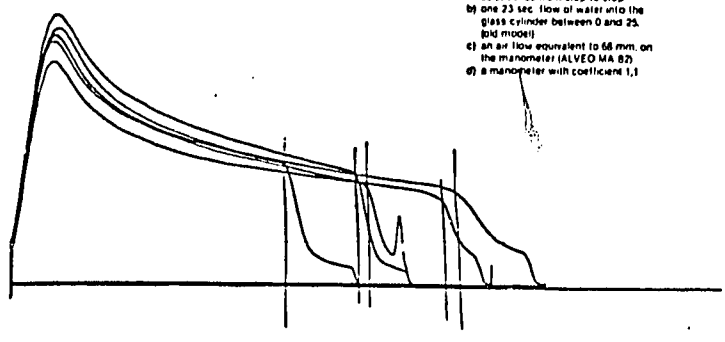
Test N° ..... Date 12/27

Subject 80% & 20%

Moisture content: % (Water addition ml)
Temperature - Laboratory °C Relative humidity %

W = 6,54 x S 41,9 = 274 x 10^{-4} joules

The coefficient 6,54 is valid for :
a) one rotation of the drum lasting 55 seconds from stop to stop
b) one 23 sec. flow of water into the glass cylinder between 0 and 25. (old model)
c) an air flow equivalent to 68 mm. on the manometer (ALVEO MA 82)
d) a manometer with coefficient 1,1



sI cm² = E x A =

p = MN x 1,1 = m/m

7,4
7,0
6,8
6,6
6,1

P = H 6,8 x 1,1 = 7,5 m/m

sII cm² =

SC'

6,2
7,
6,1
6,4
6,6
6,5

L = ON m/m

P 7,5 / L 10,2 = 0,74

G =

sIII cm² = ZN x ZF =

S cm²

MIXOGRAPHS

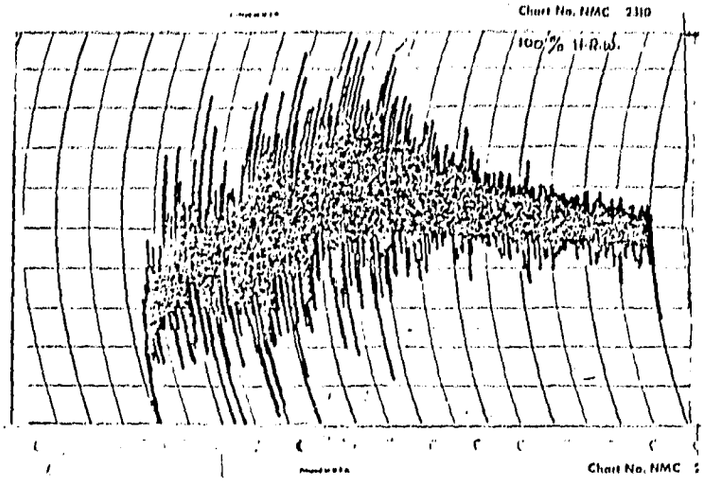
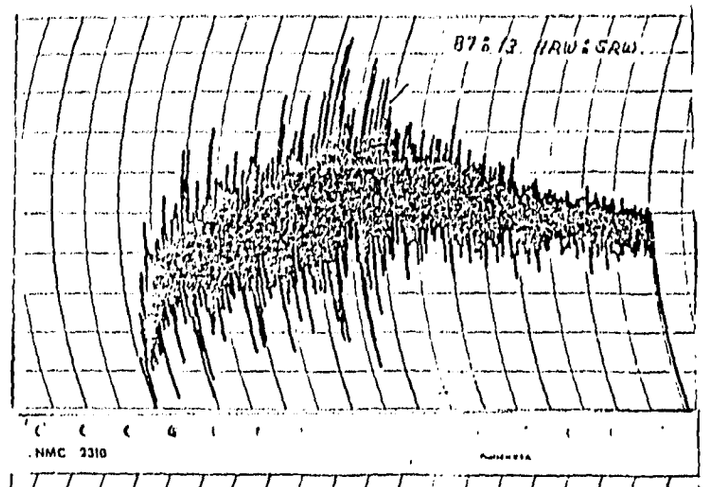


Chart No. NMC 2310
100% H.R.W.


87 & 13 HRW : SRW
NMC 2310

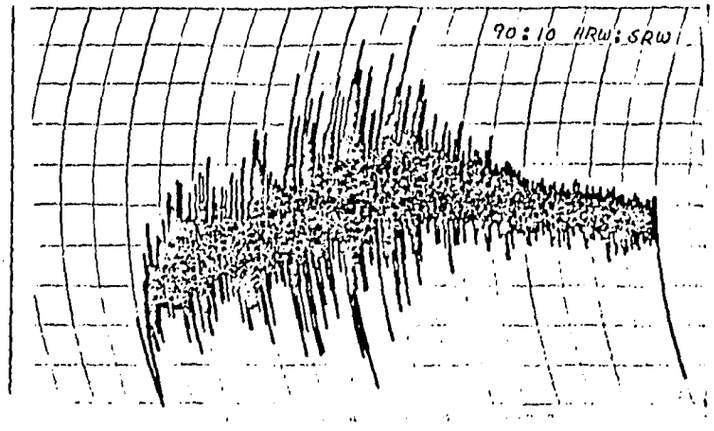
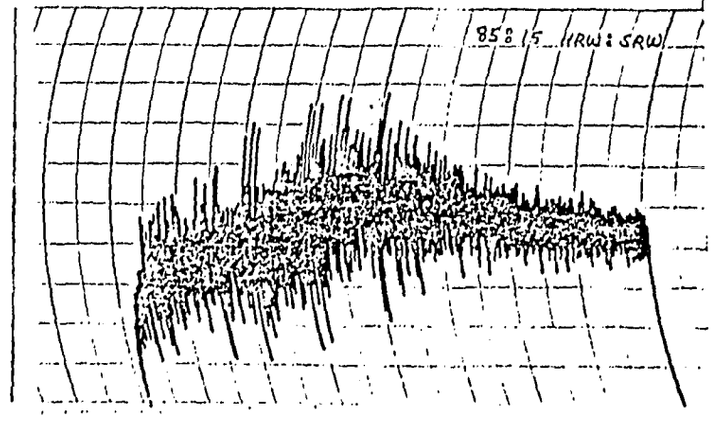


Chart No. NMC
90 : 10 HRW : SRW


85 & 15 HRW : SRW

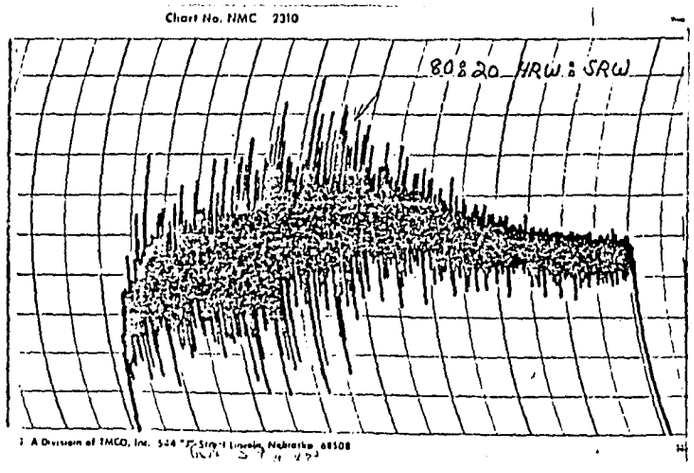
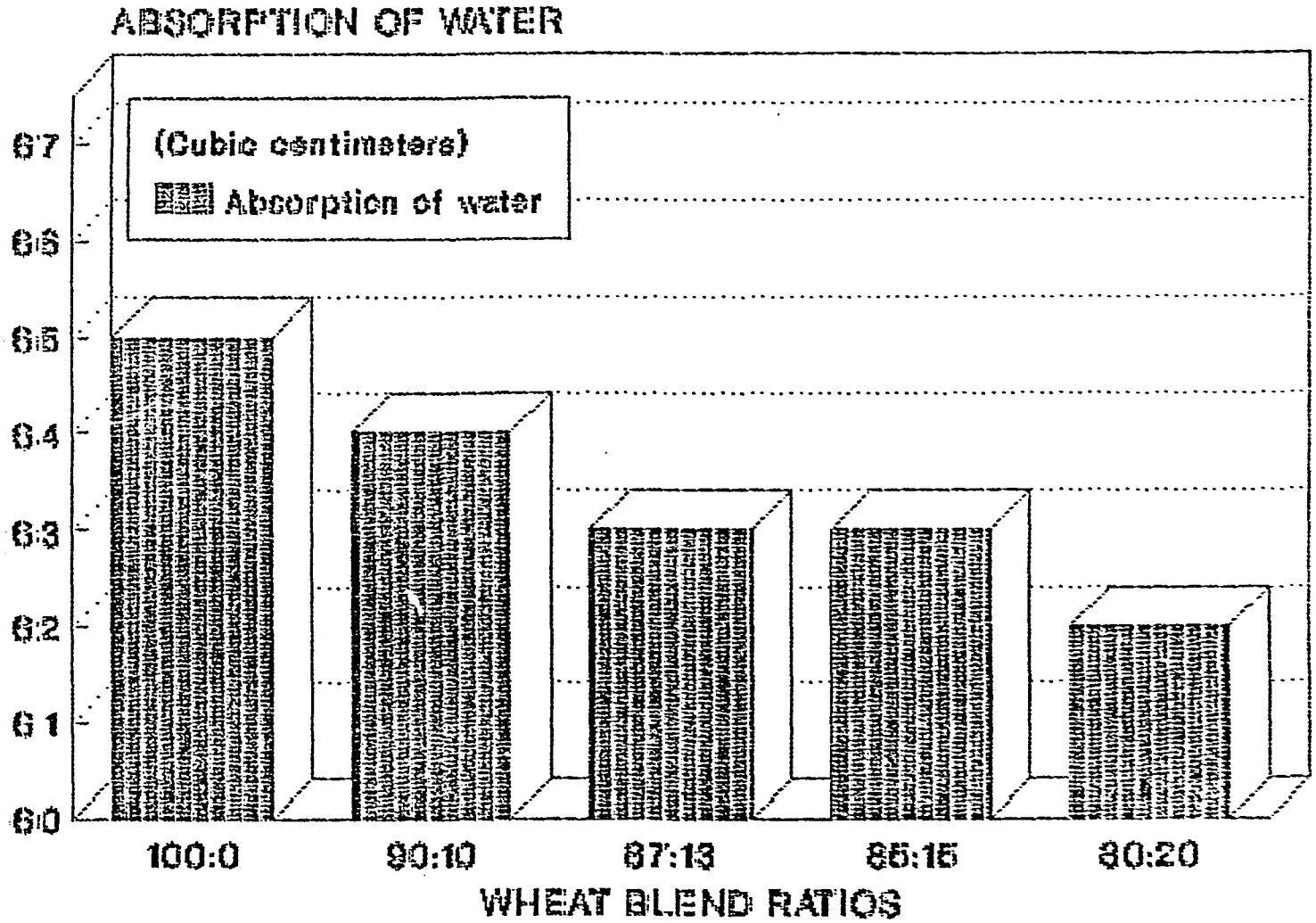
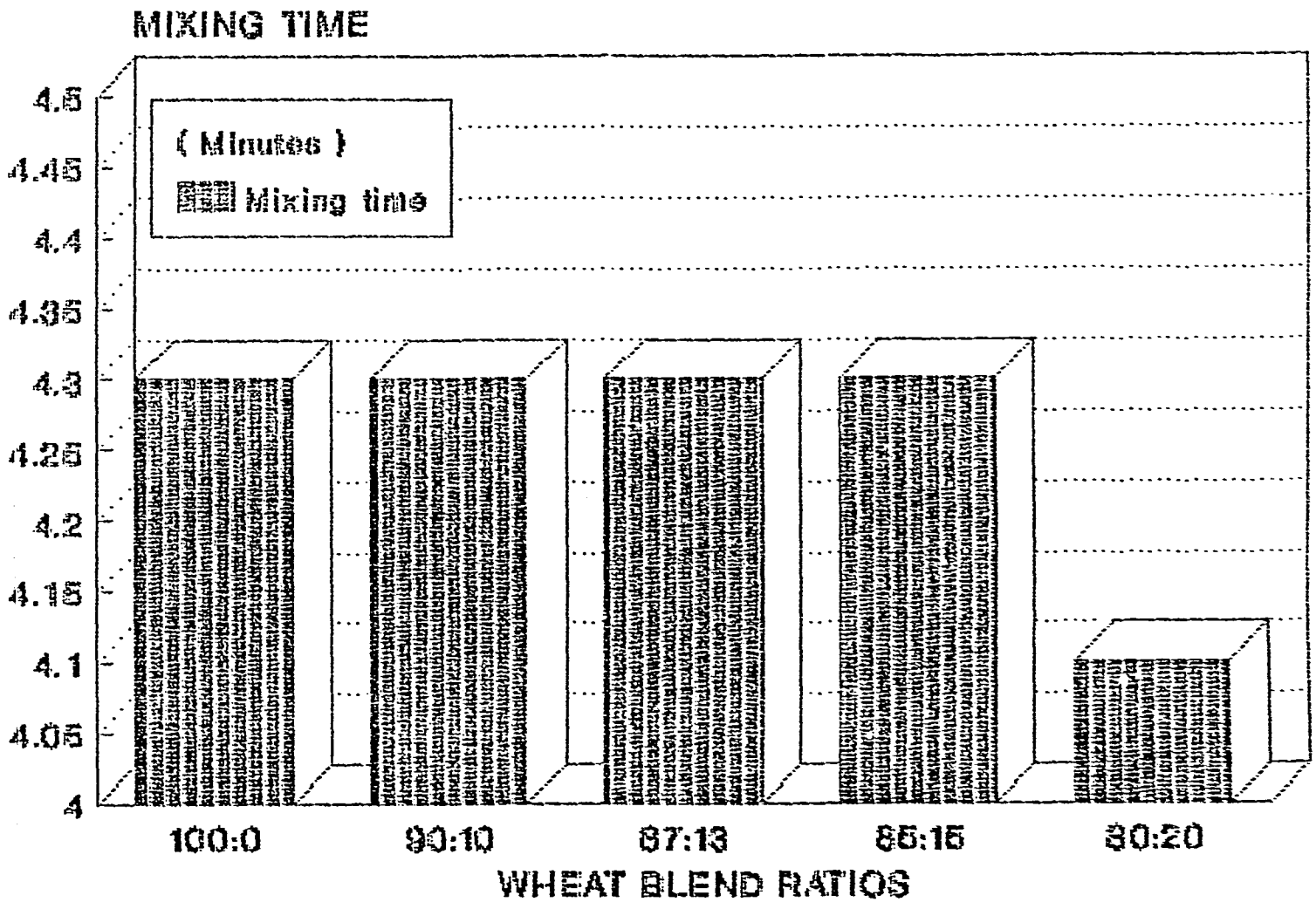


Chart No. NMC 2310
80 & 20 HRW : SRW
A Division of TMCO, Inc.

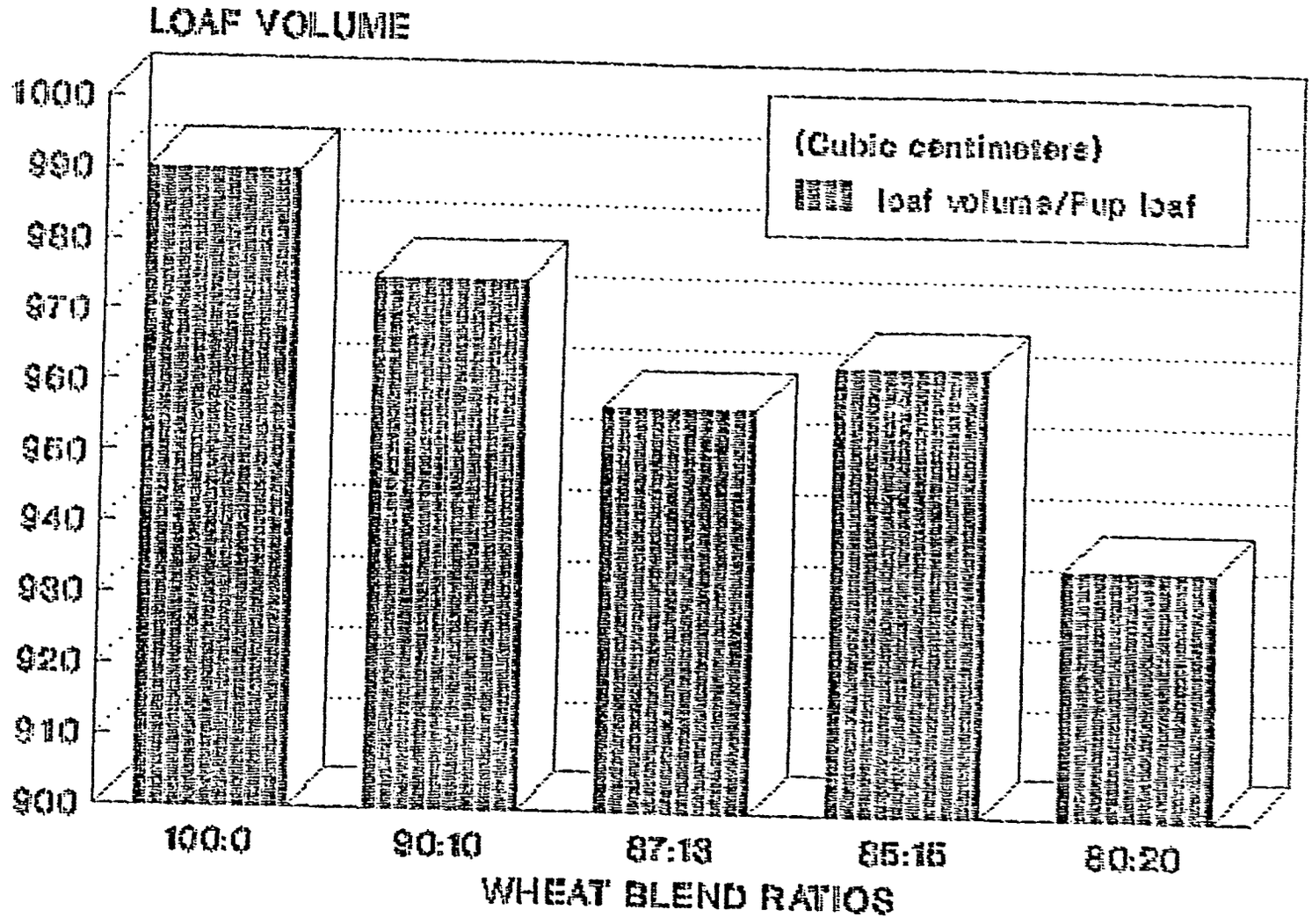
BAKING CHARACTERISTICS OF WHEAT BLENDS
(Hard red winter / Soft red winter)



BAKING CHARACTERISTICS OF WHEAT BLENDS
(Hard red winter / Soft red winter)



BAKING CHARACTERISTICS OF WHEAT BLENDS
(Hard red winter / Soft red winter)



From the results tabulated in Table 1 and also shown in bar graphs, there is little variation in test weight and 1,000 kernel weight between the 100 percent HRW sample and the blended samples of 90:10, 87:13, 85:15, and 80:20. HRW to SRW wheats 100 percent HRW wheat sample recorded the highest pearling value which verifies the hardness of the wheat. From the wheat size test, it was evident that the SRW wheat kernels were more plump and larger in size in comparison with the HRW wheat kernels. However, the theoretical yields calculated suggested that there would be very little variation in the expected milling value or extraction rates. In actuality, the experimental milling tests done on the "Quadrumat Senior" experimental mill yielded the same type of results. There was very little difference in the straight grade flour extraction rates.

Mixograph tests and alveograph tests were conducted to physically evaluate the dough. These tests showed that the flow from the 100 percent Hard Red Winter wheat had superior dough strength as reflected in the mixing time, absorption, and the "w" value of the alveograph (which is normal for this class of wheat). However, the wheat blends up to 85:15 HRW to SRW, yielded comparable and acceptable values, 4.3 minutes adjusted mixing time, 63 c.c. water, and 291 x 10^3 ergs 'w' value suitable for bread baking.

However, the 80:20 blend sample recorded a dramatic decrease in the corresponding values.

The baking data were closely related to the physical dough test results. The HRW flow produced bread of good quality with loaf volume of 990 c.c. and good crumb characteristics. Flour from the wheat blends up to 85:15 also produced bread of reasonably good quality with a loaf volume of 963 c.c. and good crumb characteristics. Only the flour from the blend 80:20 recorded a sharp decrease in loaf volume.

Summary

From this study, it was concluded that up to a blending ratio of 85:15, HRW to SRW wheat blended together produced flour comparable in quality, extraction rates, and baking characteristics to flour from 100 percent HRW wheats. Beyond the 85:15 blending ratio for flour ground from the 80:20 blend ratio, there was a decline in the values obtained in the physical dough testing and baking data indicating the need for fortification to bring it to the standard.

APPENDIX III

SCHEDULE OF CORRECTIONS OF OPERATIONAL PROBLEMS

SCHEDULE OF OPERATIONAL PROBLEMS CORRECTION

Jobs	Location	Starting Date	Duration	Technicians	Observations
Wheat scale to tare	7th floor Smutt	August 1989	3 days	fabrice/simeon	Executed on time
Scale cover to replace	7th floor Smutt	October 1989	2 days	Bornelus/Derilien	In process
Manufacture of falling	7th floor Smutt	October 1989	30 days	Brutus/Godeus Blaze/Macenat	In process
Inspection stairs on storage bins to repair	6th floor Smutt	September 1989	10 days	Gabriel Remy/Kelly J	Executed on time
Chain cover	6th floor mill	September 1989	2 days	Macenat & 1 helper	Executed on time
Son de blé scale to make working	5th floor mill	October 1989	10 days	fabrice/simeon	In process
Counter to install on flour bag conveyor	Packing	September 1989	1 day	Vincent/Daniel	Executed on time
Counter to install on Son de blé bag conveyor	Packing	September 1989	1 day	Vincent/Daniel	Executed on time
All covers to replace	5th floor mill	August 1989	1 day	Jean Luckner	Executed on time
Repairing conveyor cover	5th floor mill	August 1989	1 day	Macenat	Executed on time

SCHEDULE OF OPERATIONAL PROBLEMS CORRECTION

Jobs	Location	Starting Date	Duration	Technicians	Observations
Pipe from magnetic divider to repair	5th floor Smutt	5th mill stopping	1 day	Metal working team	Executed on time
Repairing of conveyor P12	6th floor Smutt	5th mill stopping	2 days	Metal working team	In process
Manufacture of 55 elbow for the mill	Machine Shop	October 1989	10 days	Brutus/Godeus	In process
Cyclone for precleaning	Wharf	September 1989	15 days	Gedeus/Bornelus Brutus	Executed on time
Glass to change on mill	2nd floor mill	One mill stopping	1 day	Adelson	Glass ordered from Sangoti, not delivered yet
Pipe feeding the Simpactor	2nd floor mill	July 1989	4 days	Merilien/Macouat	Executed on time
Electronic system on truck scale	Main entrance	September 1989	2 wks	Industrial Service	Executed on time
Repairing of pneumatic lifts	1st to 6th floor mill	December 1989		Metal working team	Executed on time

SCHEDULE OF OPERATIONAL PROBLEMS CORRECTION

Jobs	Location	Starting Date	Duration	Technicians	Observations
Fixation of pipes	4th floor Mill	July 1989	4 days	Gordeus/Merilien	In process
Getting out of unused pipes	4th floor Mill	July 1989	4 days	Godeus/Macenat	Executed
Manufacture of exit for P63 - P80	Machine Shop	September 1989	4 days	Brutus/Godeus	Executed
Manufacture of 8 inches elbow	Machine Shop	September 1989	6 days	Macenat/Brutus	Executed
Repairing of P04/P05	4th floor Smutt	2nd mill stopping		Metal working team	Executed
Repairing of dist. P23	4th floor Smutt	3rd mill stopping		Metal working team	Executed on time
Repairing of Stoner P36	3rd Floor Smutt	2nd mill stopping	3 days	Metal working team	Executed on time
Pipe to repair	5th floor Smutt	4th mill stopping	2 days	Metal working team	Executed on time
Pipe feeding bins to repair	5th floor Smutt	4th mill stopping	1 day	Metal working team	Executed on time
Pipe from the elevator to repair	5th floor Smutt	4th mill stopping	1 day	Metal working team	Executed on time