

MOISTURE PROFILES OF SEVERAL GRAINS  
AS INDICATED BY ELECTRICAL MEANS

by

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DUE TO LIGHT  
PRINTING  
THROUGH OUT IT'S  
ENTIRETY.**

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## INTRODUCTION

### Objective of the Study

The objective of this study is to develop moisture absorption profiles, as indicated by each of three different electrical moisture meters, for different small grains showing (1) the rate of water absorption using one temper and (2) the rate of water absorption using two tempers.

### Problem Statement

Throughout the history of milling a difference of opinion has existed regarding the tempering time required for proper conditioning of grains prior to the beginning of the grinding process. The majority of claims made were based on the fact that millers designed for mill construction on the exact time required for complete absorption of the water by the grain kernel.

Several studies have been performed on the rate of water penetration into several wheats. With the World food shortage problem becoming a reality, the milling industry is expanding into milling areas other than wheat. If the miller of grains, other than wheats, is to operate at a profit, he must be able to extract the maximum amount of high grade material with the least amount of cost. In this study penetration profiles for several different grains denoting the rate of water penetration are presented showing where tempering times may vary between grains, and even among varieties of the same type grain.

The primary objective of conditioning is to have the moisture distributed in such a way that the bran is tough enough to resist attrition and abrasion and yet be clearly separated from the endosperm, and to mellow the endosperm so that it reduces easily in the reduction system with the least amount of pressure and to release the maximum amount of quality flour with a minimum

consumption of power. In this study an attempt was made to show how fast the added water is picked up and absorbed by the kernel during the first three hours after adding the required amount of water for proper milling.

## LITERATURE REVIEW

During the early history when millers began to make flour by the gradual reduction roller system, it was quickly found that many of the harder varieties of wheat were very difficult to grind satisfactorily. The kernels splintered into irregular hard portions because they were so hard and brittle. This made it very difficult to reduce the endosperm to flour with smooth rolls, and the branny particles cut off by the break rolls became powdered during the reduction process, causing the flour to be coarse and specky. The hard, brittle kernels also made it impossible to get high extraction rates and caused the flour to be unfinished (44).

Numerous investigators (39), (43), (50), (55), (61) have presented the objectives of conditioning. Kent (39) found that as the moisture content of grain increases, the bran becomes tougher and less brittle, the endosperm becomes mellower and more friable; but cohesion between the bran and endosperm becomes stronger, so that the endosperm is less easily detached from the bran.

There is an "optimum" grain moisture content which will give the best milling results: high enough to mellow the endosperm and toughen the bran adequately, but not too high to hinder satisfactory cleaning of the bran and sieving of the stocks (49).

Miller (43) felt it was necessary to apply more water than was required for the middlings of wheat, and allow the wheat mass, after a number of hours, to come in contact with drying air-currents, to insure an even distribution of moisture throughout the berry. The purpose of the dry air-currents was to cause the bran to re-absorb some of the moisture from the outer part of the endosperm, which was thought to be wetter than the innermost part of the floury endosperm.



Bradbury, Cull and MacMasters (7) felt that successful tempering of the grain was related to the structure of the various layers covering the endosperm, because toughness of the bran and mellowness of the endosperm were dependent upon the entrance and the proper distribution of the added moisture.

Pence and Swanson (48) found it necessary to define the words adsorb and absorb early in Rate of Water Penetration discussions. The definitions were taken from the New Century Dictionary: Adsorb means to gather on the surface of the molecules in a condensed layer, while absorb means to take up by chemical or molecular action. In evaluating the definitions, they found that absorption takes place when the water penetrated the wheat kernels.

#### Factors Affecting the Rate of Penetration

Several investigators (7), (12), (26), (30), (33), (35), (46), (58), (59) have studied the entrance of water into the wheat kernel with regard to tempering and conditioning of the grain for milling. Bradbury, Cull and MacMasters (8) felt that it was essential to have complete knowledge of the kernel structure because it had a direct influence on the absorption of moisture.

It was reported by many investigators (6), (12), (33), (45), (53), (56), (59) that entrance of water into the kernel was first and most abundantly through the germ end. Eustace (20) indicated quick absorption at the germ end was because the germ had no cuticle covering it. There are also many intercellular spaces in the parenchyma tissue, allowing for quick passage of water.

Fritsch (27) found water entrance into the kernel to be slow, because (1) the outer germ tissue quickly imbibes until full and forms an equalizing water reservoir, and (2) there occur in the water-conducting capillaries microscopically small air bubbles that set up a strong resistance to the water movement.

The moisture, after leaving the germ area, travels upward through the pericarp toward the beard end in the area of thin-walled cells. Another area for quick movement of water is the intercellular spaces among the intermediate, cross, and tube cells located over the lower part of the germ and along the dorsal surface of the kernel (7).

Ugrimoff (59) found that water, in much smaller amounts, is absorbed into the kernel equally through the entire kernel surface. He found also that absorption occurred where the kernel was in direct contact with the water.

While the structure of the pericarp accounts for the rapid initial pick-up of water by a wetted kernel (7), (33), (52), it is the nature of the seed coat that helps to explain the subsequent slow absorption of water. Bradbury (7) and Grosh (29) found that breaks in the outer layers of kernels, which occur during tempering, provide a pathway for quick movement of water into the endosperm. However, Grosh (29) found that in tempering soft or mealy kernels, the cracking phenomenon was of no significance because the evidence of cracking could not be found. He also felt that hard vitreous kernels absorb water faster because of the cracks being formed allowed for faster moisture distribution. Becker (3) found that absorption of liquid water by the wheat kernel proceeded by a heterogeneous mechanism, there being a very rapid initial absorption in which the pericarp was saturated by capillary imbibition.

Neumann (45) reported that in glassy wheat the entrance of water into the kernel begins later and goes on more slowly; with soft wheats absorbing water more quickly.

Farrell (22), Fraser (26), and Herd (32) found soft wheats absorbed less water than did hard wheats and that moisture equilibration was reached sooner in soft wheats.

Borg (5), Bradbury (8), Fraser and Haley (26), and Hart (31) found that smaller kernels absorbed water slightly faster than did large kernels. This finding was attributed to the larger absorbing surface of the small kernels. Nuret (46) also established that kernel size influenced the amount of water absorbed as well as did immersion time.

Several investigators (7), (45), (52) found absorption of water through the bran to be limited by the hyaline layer. Hinton (33) felt the rate of inward movement of water was slowed by the testa rather than the hyaline layer. The testa was also found by Hinton (33) to limit the water taken up by wheat during washing to that which could be absorbed by the pericarp.

Campbell (15) found that penetration of water to the endosperm near the periphery of the cheek within the crease and to the cheek center of wheat was as much as one-third the rate of the remaining endosperm. In ordinary moistened grain, the endosperm near the crease was among the last areas to reach the final level of moisture content. Jones (35) stated there was no entry of water near the crease.

The softer varieties of wheat usually have an open crease. Tempering water usually finds its way directly into such a crease, coming in contact with the very bottom almost at once. The endosperms of such wheats are less compact than are those of the vitreous kinds, requiring much less time for water to reach the innermost portions of the berry (42).

Most hard wheats have creases which are virtually closed where the cheeks of the berry meet. To reach the center of the berry, water will have to pass through the bran-coat which forms the sides of the crease and be carried there by capillary attraction (42).

Campbell (13) also determined that any increase in rate of water penetration in scoured wheat was confined to the endosperm near the bran along

the back of the grain. In this area it took five hours to reach moisture equilibrium as against fifteen hours in unscoured wheat.

Fraser and Haley (26) listed time, temperature and variety of a particular grain as factors that affected the rate of moisture penetration.

Pence and Swanson (48) drew four conclusions as to rate of water penetration:

(1) The kernel is not enclosed in a non-permeable membrane, but absorbs water freely through the entire bran surface.

(2) The bran coat has a greater affinity for water than does the endosperm.

(3) Temperature influences the rate at which water may enter the kernel.

(4) At 64°F or above, the water had penetrated the wheat kernel in two hours, and was evenly distributed throughout the endosperm.

Pence and Swanson (48) also found upon testing that wheat immersed in water absorbed water rapidly at first, thereafter as the length of time increased, the amount of water absorbed gradually decreased. Farrell (22) had similar results to those found by Pence and Swanson (48) while working with wheat. These test results tend to indicate that as wheat becomes filled with water, the rate of absorption diminishes.

Farrell (22) found that different wheat classes absorbed water at different rates. He found that difficulties arise when soft and hard wheats are blended because soft wheat absorbs greater amounts of water faster, having more moisture, and the hard wheat having too little for best milling.

Schafer (53) found individual grains to be the controlling factor in water-absorbing ability of wheat differences according to variety.

Fisher and Jones (24) found by testing that rate of moisture penetration was dependent upon dryness and not to hardness. It was necessary to wet and

whizz dry durum wheats several times at intervals in order to raise moisture content from 8-10% to 16-17%. It was impossible to raise the moisture content in one whizzing, because the surface of the kernel could not retain the required amount of water to raise the mixture to desired moisture level.

It was discovered by Forster (25) that dirty and impure grains would not take up water at the same rate as clean, polished grain. He found that force of attraction between the water and grain itself or the force of adhesion affected the amount of water adsorbed and time required for its adsorption. In short tempering, it was necessary to first remove all dirt and impurities from the grain in order to control the water distribution throughout the berry in a given period of time.

#### Moisture Determination

It was stated by Amos (1) that moisture testing as a means of determining the state of wheat in either the natural or the conditioned state is quite an established feature of the flour mill. In testing raw wheat for the per cent of moisture, the results obtained should govern the treatment of that grain. The difference of one or two per cent, would naturally alter the treatment and the cost of preparation for milling.

Measuring moisture electrically has been a problem for many years. The electrical properties of grains vary throughout the country, and thus register different results when tested. These electrical properties also vary from day to day. The main cause of electrical-property variation is probably due to the water distribution within the grain. "Free" and "Bound" water are related to moisture measurement with electrical type meters. "Bound" water is water which is tightly linked within the molecular structure of starch, protein, and other components of grain to such an extent that it is essentially a part of the

physical structure, although not the chemical structure, of the molecules (16). The dielectric constant of "bound" water is essentially the same as that of the molecule with which it is associated; and since it is not capable of dissolving mineral salts while so bound, it is a nonconductor of electricity (47). "Free" water is defined as water which is capable of acting as a solvent and is found in the interstitial spaces between the larger molecules. Since this water contains dissolved salts, it can conduct electricity. Its dielectric constant is close to the value of 80 for pure water when it contains very little dissolved matter (16).

The determination of moisture is by no means simple as stated by Kent, Jones and Amos (38). The moisture would seem to be combined with varying degrees of affinity. Hence, different methods of determining moisture tend to indicate in the same sample different moisture contents.

Christensen (16) found that great differences in dielectric value exist between the Motomco and Steinlite moisture meters even though both measure "free" and "bound" water. The great differences in dielectric value of these two types of water may introduce errors in measurement when the ratio of the two shifts. Christensen (16) found the Motomco to be decidedly less influenced by electric variations, constantly showing less deviation from the oven method value than any other electric meter tested.

Test conducted by Geddes and Winkler (28) found the Tag-Heppenstall very useful for moisture content determination of ground wheat even though it was designed for use on whole grain.

Working (60) found the Tag-Heppenstall moisture meter to have two rectifier circuits which fulfilled current requirements, one of which permitted adjustment of its output voltage over a wide range.

It was discovered by Coleman (18) that the Tag-Heppenstall moisture meter could not determine accurate moisture content of low moisture, low temperature grain. Grain covered with ice or snow also offers resistance to accurate testing because of the free moisture present on the surface of the grain.

Coleman (18) found that grain moisture estimation by conductivity measurements depended upon the variation in electrical resistance with the change in moisture content of the grain. The measurement of resistance is based on Ohm's Law, which states that the strength of a current equals the electromotive force divided by the resistance.

It was discovered by Sair and Fetzner (51) that the Official Brown Duvel method underestimates the moisture in corn by values ranging from 1.4% to 2.1%. They also discovered corn values were underestimated 1.2% to 2.3% when tested with the Tag-Heppenstall moisture meter.

## MATERIALS AND METHODS

The samples of grain used in this study were:

- (a) Hard Red Winter Wheat; several varieties from different areas of the country,
- (b) Durum Wheat,
- (c) Western White Wheat,
- (d) Soft Red Winter Wheat,
- (e) Red Grain Sorghum,
- (f) Yellow Corn,
- (g) Oats,
- (h) Rye,
- (i) Barley.

Each of the different grains were cleaned on the Carter Dockage Tester (Plate 1) using the proper riddle, screens, feed rate and air setting as recommended by the manufacturer. The grain, after being cleaned on the dockage tester, was passed through the Kice Aspirator (Plate 1) in order to remove all dust and fine foreign material. The feed rate and air valve for the aspirator were adjusted by trial and error so as not to remove any of the grain.

The moisture meters used in the test were:

- (a) Official Brown Duvel,
- (b) Motomco,
- (c) Steinlite,
- (d) Tag-Heppenstall.

Each of the moisture meters operates by a different principle. The Official Brown Duvel (Plate 3) uses the distillation method. The Motomco (Plate 3) operates by the principle of capacitance. The Steinlite (Plate 3) operates by the impedance principle and the Tag-Heppenstall (Plate 3) uses the conductance principle.



The Official Brown Duvel was used as the basis for official check of all test made. It was used to determine the dry moisture content for use in the tempering of the grain. It was also used for determining if the grain was raised correctly to the desired moisture content after adding the required amount of water.

Operation for each of the moisture meters was taken from the operator's manual furnished by the manufacturer; excluding the Official Brown Duvel which used the AACC Method. The schematic circuits for the Motomco, Stienlite and Tag-Heppenstall are presented in Plates 4, 5 and 6. An operational diagram for the Official Brown Duvel is presented in Plate 4.

Each test included a one-temper stage and a two-temper stage, whereby rate of water penetration of the two were compared graphically. The one-temper method consisted of raising the dry grain to the milling moisture content. The two-temper method consisted of raising the dry grain to 12.5% moisture; holding for one week in a sealed container; and then raising the grain finally to the desired milling moisture content. The moisture added to the grain, for each method, was calculated by the following formula:

$$\frac{(100 - M_1)}{(100 - M_2)} \times W_1 = W_1 + B$$

$M_1$  = Per cent of original sample that is water.

$M_2$  = Per cent of tempered sample that is water.

$W_1$  = Total weight of original sample.

$B$  = Weight of the water to be added.

The water was added to the grain in a rotating drum (Plate 7). Fifteen minutes were allowed for the mixing of the water with the grain. Then after fifteen minutes of mixing in the rotating drum, the wetted sample was placed

in a plastic bag, tied and sealed in a metal can. The required weighed amount of grain was removed from the sealed can at each predesignated time interval and the moisture content determined. Time zero was the time the grain was placed in the plastic bag and sealed in the can.

For the test in which the wheat was scoured the Forester laboratory scourer (Plate 1) was used. The grain was passed through the machine once at an operating speed of 2150 RPM prior to passage through the dockage tester.

The Miag Laboratory Wheat Conditioner (Plate 2) was used to heat the wheat used for the cold versus hot wheat test. The conditioner was preheated prior to placing the wheat sample into the heating drum. The sample remained in the conditioner until the grain reached 110°F. The heat was conducted to the wheat from electric heating elements located in the rotating drum.

The water was added to all samples, except for the hot water treatment, directly from the tap at a temperature of 72-75°F. The water for the hot water treatment was heated to 110°F in a glass flask.

The test weight per Winchester bushel was determined on an approved apparatus (Plate 1) by the method prescribed by U.S.D.A. Circular No. 921.

The method used to evaluate the actual rate of water penetration was based on the principles of operation for the moisture meters. When freshly tempered grain was placed either into the test cells of the Motomco and Steinlite or passed between the rolls of the Tag-Heppenstall, the current passed easily across the grain giving a higher moisture indication; if not beyond its reading capability. Then as the water penetrated into the kernel, the ease of current flow was decreased; thereby giving a lower moisture indication until finally one of the meters gave a reading which was within 0.25% of the desired moisture content.

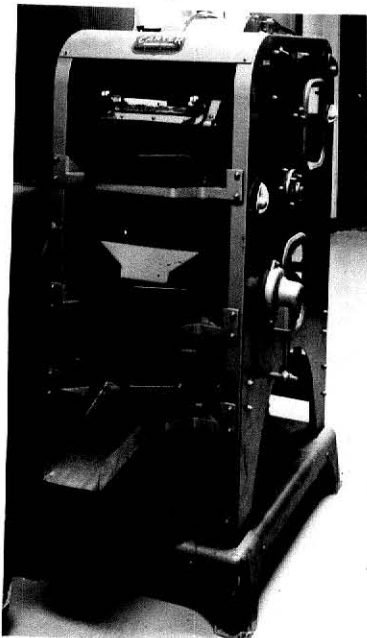


PLATE 1

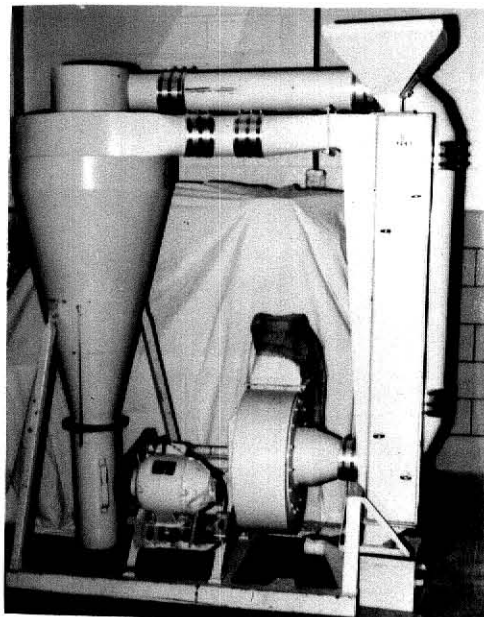
- A. Carter Dockage Tester
- B. Kice Aspirator
- C. Forester Laboratory Scourer
- D. Test Weight Apparatus

## PLATE 1

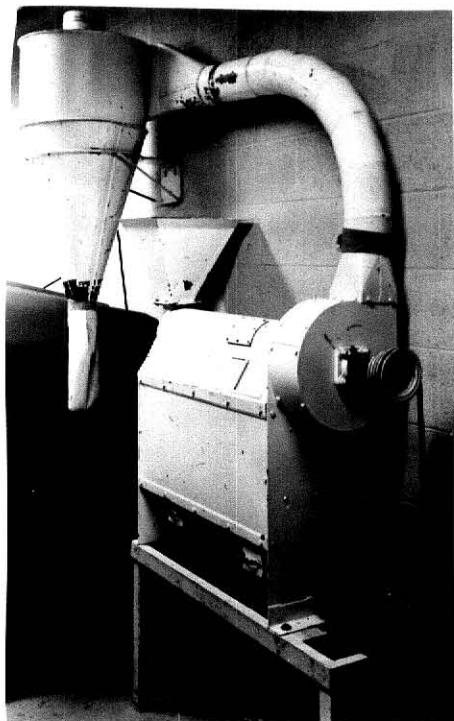
A



B



C



D





PLATE 2

Miag Laboratory Wheat Conditioner

PLATE 2

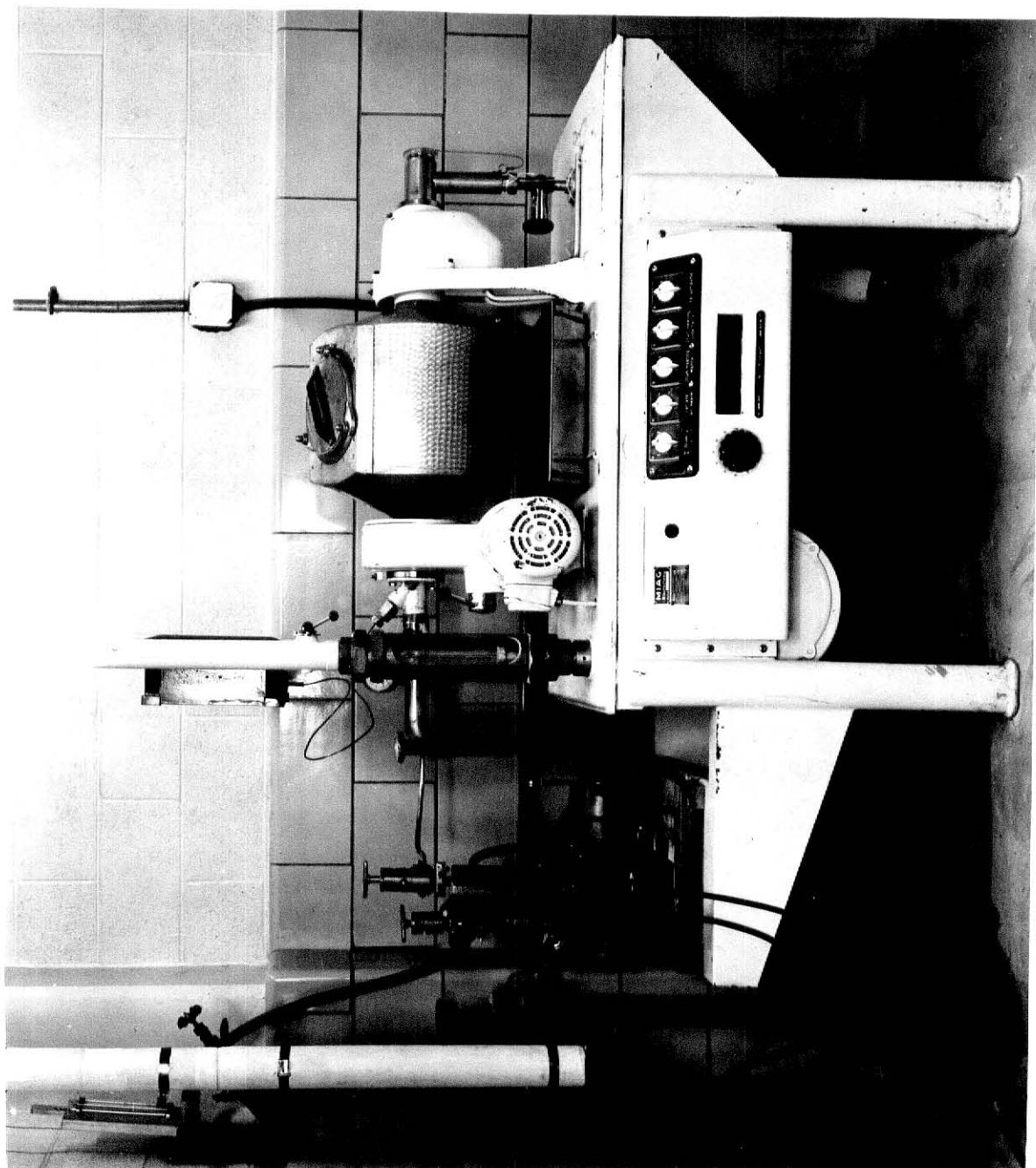




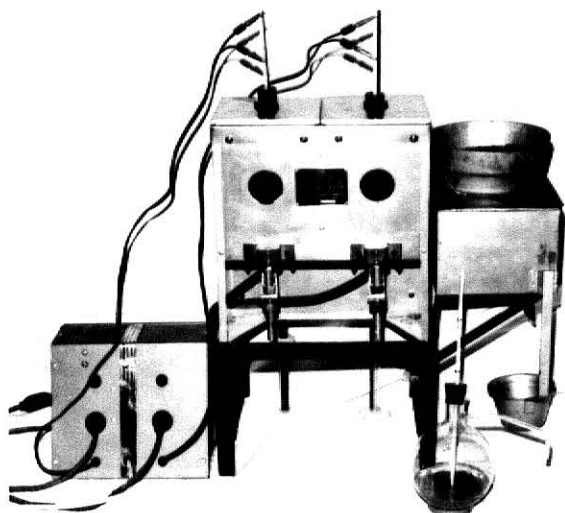


PLATE 3

- A. Official Brown Duvel Moisture Tester
- B. Motomco Moisture Meter
- C. Steinlite Moisture Meter
- D. Tag-Heppenstall Moisture Meter

## PLATE 3

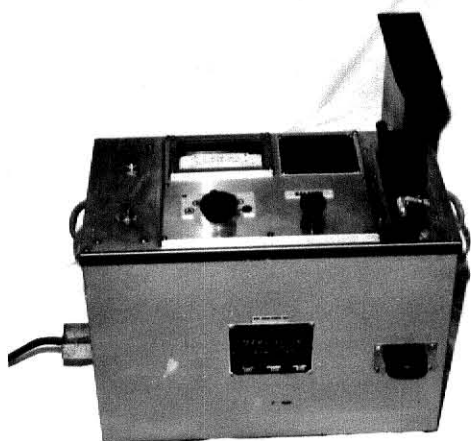
A



B



C



D

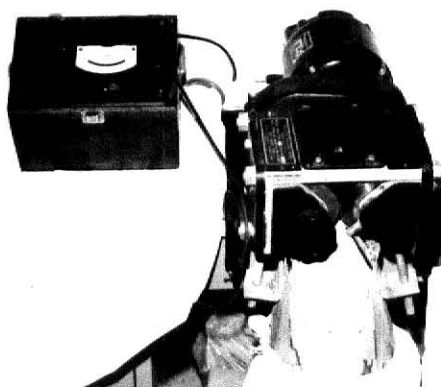




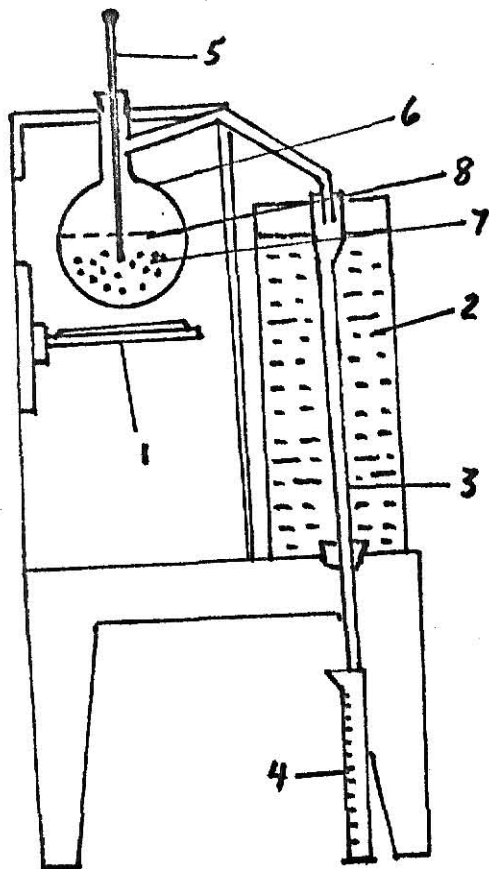
PLATE 4

- A. Official Brown Duvel Operating Diagram
- B. Tag-Heppenstall Schematic Circuit Drawing

**THIS BOOK  
CONTAINS  
NUMEROUS PAGES  
WITH DIAGRAMS  
THAT ARE CROOKED  
COMPARED TO THE  
REST OF THE  
INFORMATION ON  
THE PAGE.**

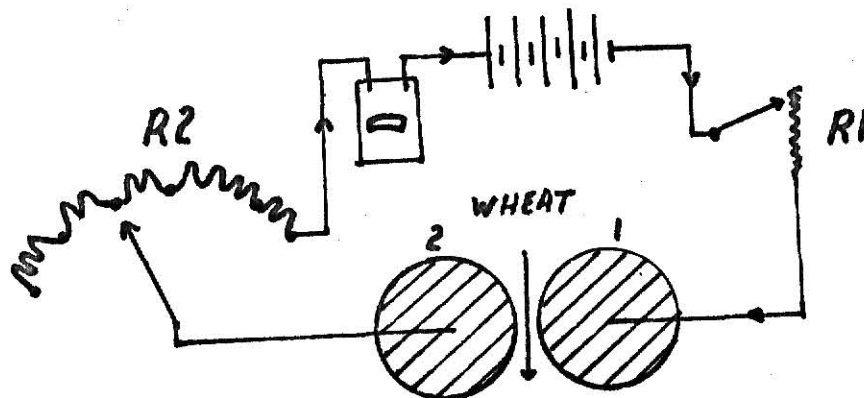
**THIS IS AS  
RECEIVED FROM  
CUSTOMER.**

A



1. Heating Element
2. Water
3. Condensate Tube
4. Graduated Cylinder
5. Thermometer
6. Distillation Flask
7. Grain
8. Oil

B







## PLATE 5

Motomco Schematic Circuit Drawing

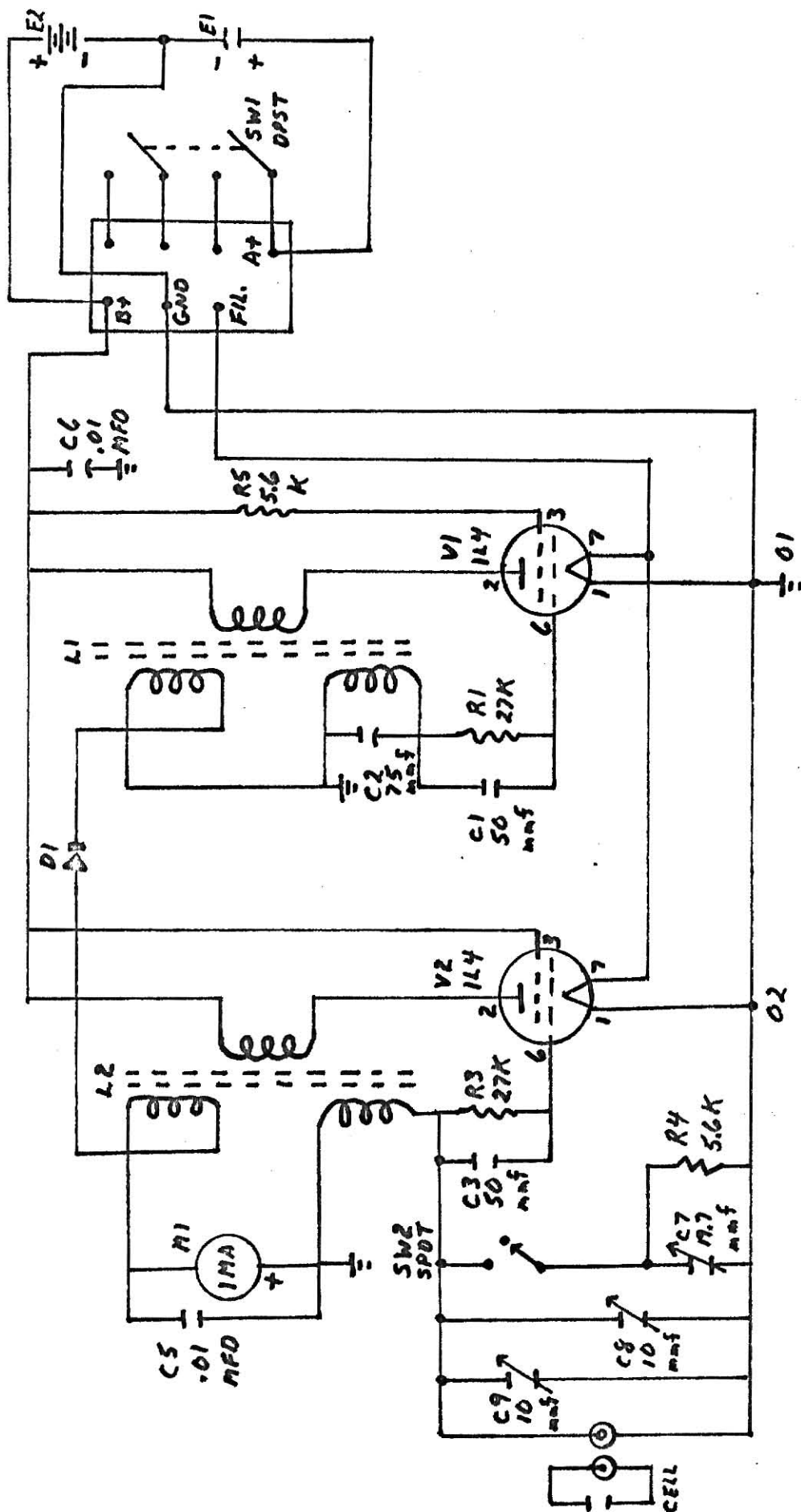




PLATE 6

Steinlite Schematic Circuit Drawing



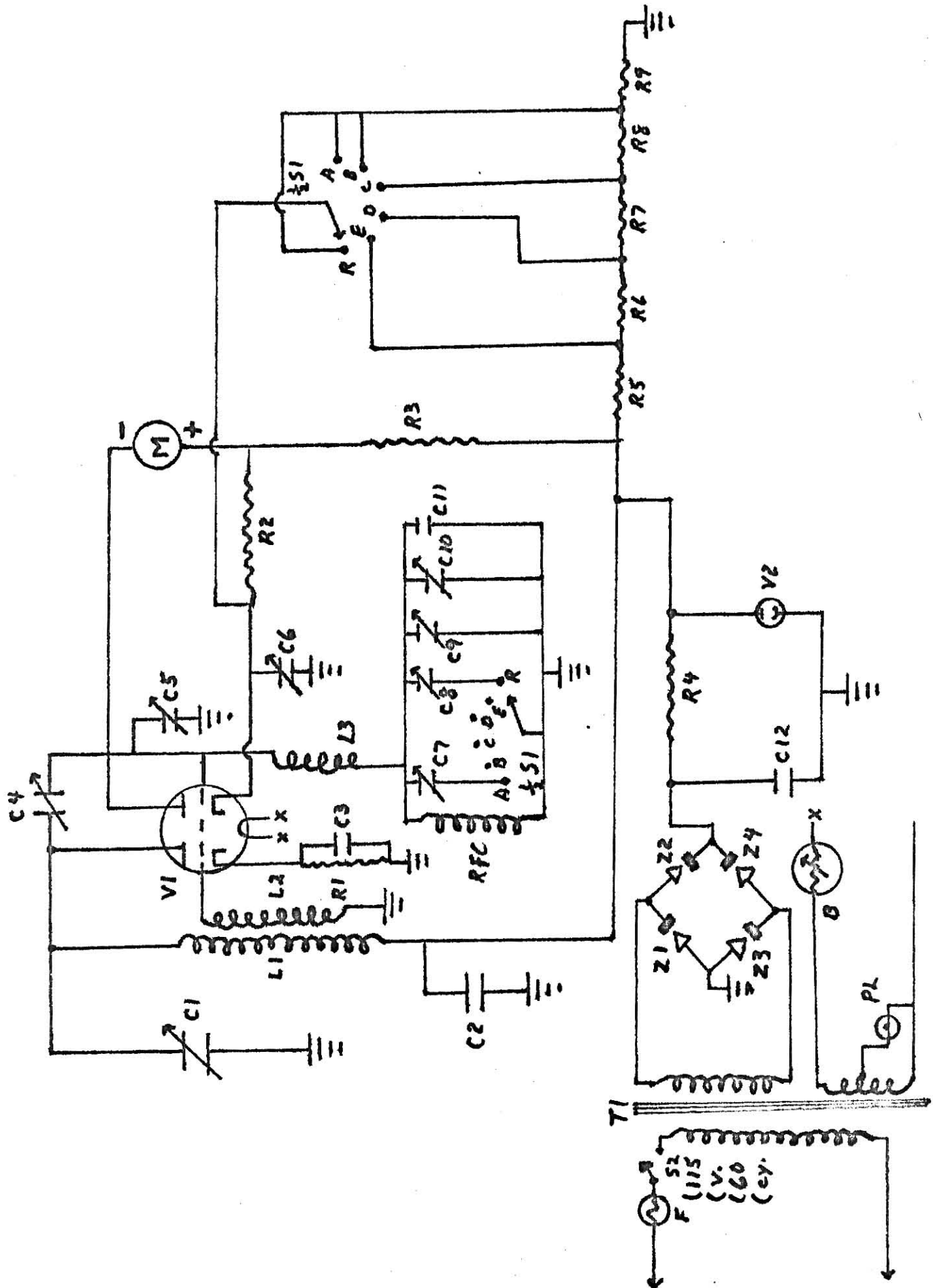




PLATE 7

Rotating Mixing Drum

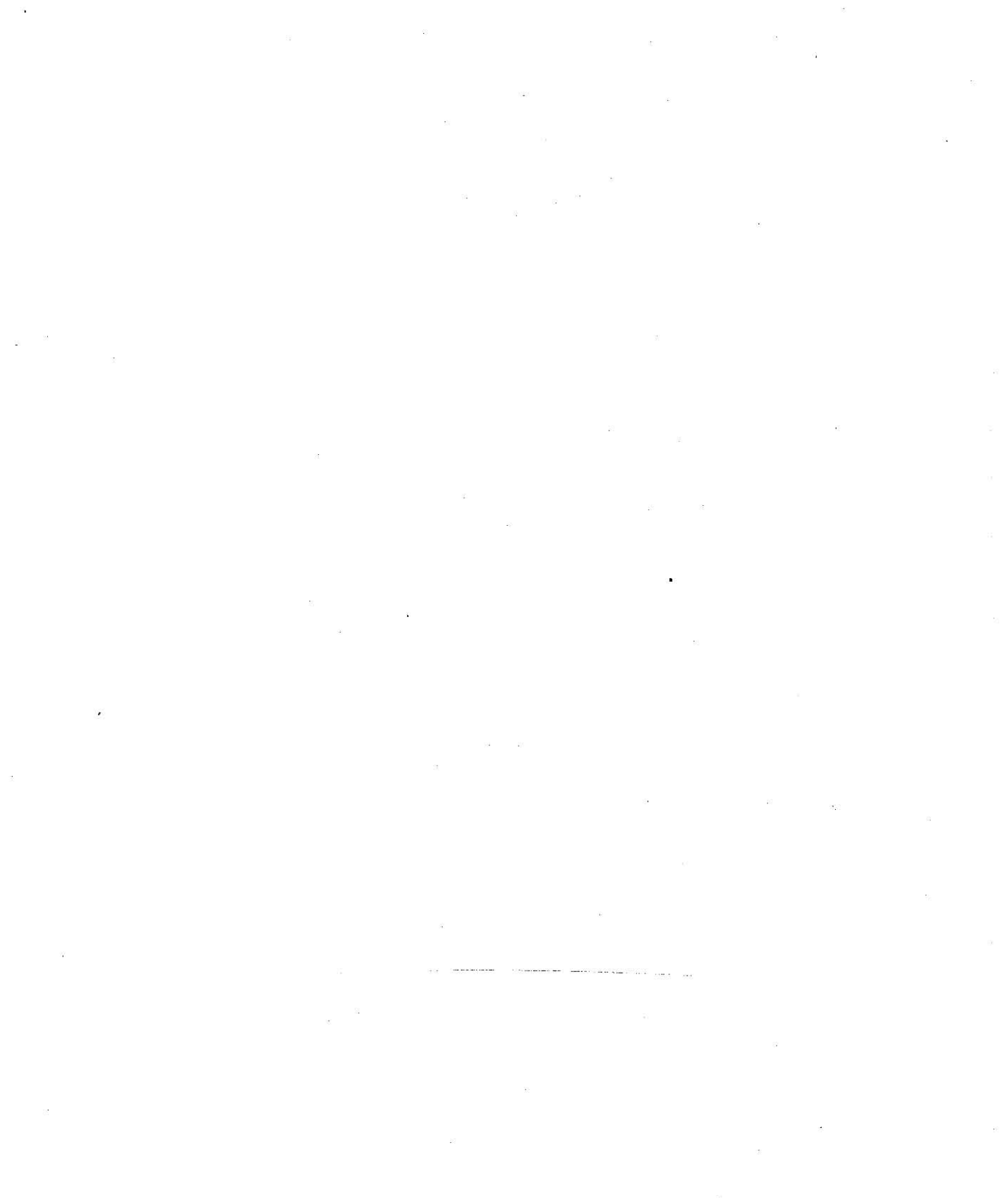
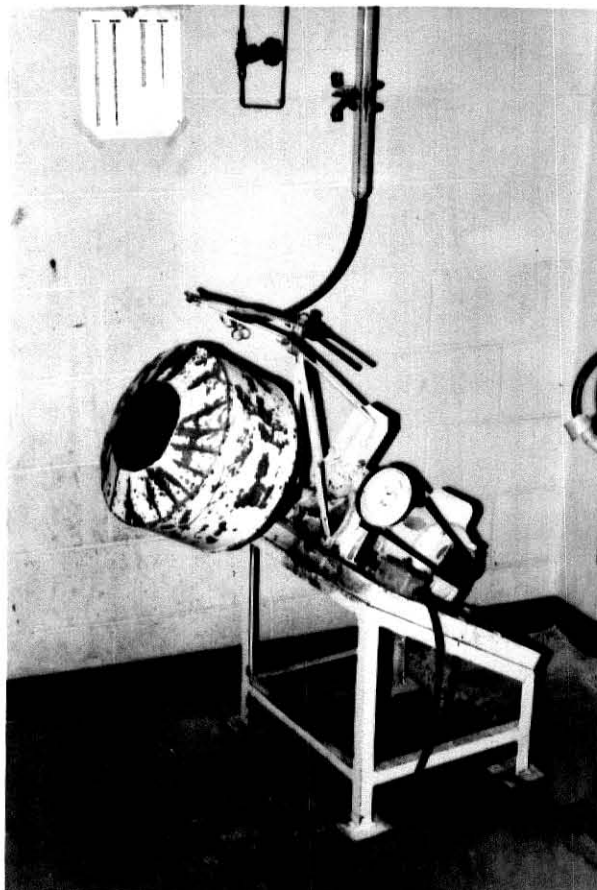


PLATE 7





## RESULTS AND DISCUSSION

The experimental results for the different grains are presented in Tables 1 through 124.

From the experimental results, rate of water penetration graphs were drawn where one stage tempering and two stage tempering results were compared (Figures 1 through 53). The Tables and Graphs vary in number of readings because moisture determinations were taken only until one of the three moisture meters read within 0.25% of the desired moisture content for a testing series. The following is a break down of the time readings:

<u>Time Reading</u>	<u>Actual Time of Temper</u>
0	15 min.
1	30 min.
2	45 min.
3	60 min.
4	75 min.
5	90 min.
6	105 min.
7	120 min.
8	135 min.
9	150 min.
10	165 min.
11	180 min.
12	195 min.
13	5 hrs.
14	9 hrs.
15	21 hrs.

Each test was duplicated with the data of each evaluation being statistically analyzed to establish that each test reading did fall within a 95% confidence interval about the mean test reading. Upon examining each of the tables, it was observed that no test reading fell outside the 95% confidence interval band.

The test weight per Winchester bushel was determined just prior to addition of temper water. The test weight results are presented on each of the

Figures. It was determined by testing that the test weight ( $TW$ ) for the two temper grains was less than the test weight for the one temper grains. It was discovered by Pence and Swanson (48) that test weight decreased with addition of moisture; even with different protein contents. Their test showed that wheats wetted and redried to the original moisture content would not regain the original test weight.

It was also observed upon examining most of the Tables that a positive sign (+) was placed by the moisture readings at the beginning of temper. The (+) sign denoted that the moisture (as determined by each moisture meter operation principle) was beyond the meters' moisture determining capability. The graphs depicted this graphically disregarding the (+) sign. As the water penetrated into the grain and the moisture reading fell within the capability of the meter, the bars of the graph became shorter in length. In some cases the bar was graphically shown to be greater in length than the maximum capability moisture meter reading due to temperature corrections and/or test weight corrections. These findings are presented in Figures 2, 5, 6, 8, 9, 14, 17, 18, 20, 21, 26, 29, 32, 33, 37, 44, 46, 47, and 52. The temperature corrections were required for the Motomco, Steinlite and Tag-Heppenstall and the test weight corrections was required for the Steinlite.

Hard Red Winter Wheat. Results in testing Hard Red Winter Wheats from different areas of the country and at different dry moisture contents are presented in Tables 1 through 47. A test was conducted for each of the tested moisture meters for each type grain to show the relationship to one another. Figures 1 through 18 show the one temper versus two temper for each moisture meter for each type grain.

For each series of test made and for each type moisture meter the two temper stage of tempering had a greater initial rate of water penetration. For the dryer grains the degree of difference between the one temper and the two temper were even more detectable.

It was reported by Fraser (26) and Swanson (59) that a longer temper was not needed to effect water distribution uniformly throughout the kernel. They found that a uniform distribution of moisture was effected in one hour's time. But this finding did not preclude the possibility of the water affecting other changes in the endosperm. As can be seen from viewing the graphs, the water is not uniformly distributed throughout the kernels after one hour's temper. The dry, harder kernels still have most of the water on the outside of the kernel.

Jones and Campbell (36) and Scott (54) reported moisture to be still moving through the endosperm after seven hours becoming stationary after twenty-six hours when tempered at ordinary temperatures. This report was in contrast to Fraser (26) and Swanson (59) who reported that water penetrated to all parts of the grain in one to three hours. Their test probably reflected only the departure of moisture from the bran into the endosperm as a whole, as it can be seen from the moisture profile graphs that water is still moving after three hours of temper. Millar (41) reported it was only possible to wet the outside of the bran, and as it was required to have the moisture distributed evenly through the berry, the grain had to lie in a bin for the water to soak through into the inside of the berry.

Tables 37 through 48 were tested only by one temper to show how water penetrated Hard Red Winter Wheat either of a different variety, or from a

Table 1. California Hard Red Winter Wheat raised from 6.8 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	24.00	24.00+	24.00+
2	24.00	24.00+	24.00+
3	24.00	24.00+	24.00+
4	24.00	24.00+	24.00+
5	24.00	24.00+	24.00+
6	22.93	22.48	23.39
7	21.76	21.90	21.61
8	21.06	21.08	21.03
9	20.08	19.69	20.46
10	18.70	18.72	18.67
11	18.12	17.94	18.29
12	17.64	17.46	17.81
13	16.17	16.01	16.32
14	16.01	15.94	16.08
15	15.76	15.81	15.71

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 55% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 2. California Hard Red Winter Wheat raised from 6.8 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	20.97	20.98	21.35
1	19.97	19.78	20.16
2	19.11	19.01	19.20
3	18.32	18.22	18.41
4	17.23	17.04	17.42
5	16.94	16.94	17.04
6	16.84	16.84	16.84
7	16.50	16.55	16.44
8	16.44	16.44	16.44
9	16.44	16.44	16.44
10	16.44	16.44	16.44
11	16.35	16.35	16.35
12	16.25	16.25	16.25
13	16.11	16.11	16.11
14	16.11	16.16	16.06
15	15.83	15.82	15.84

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

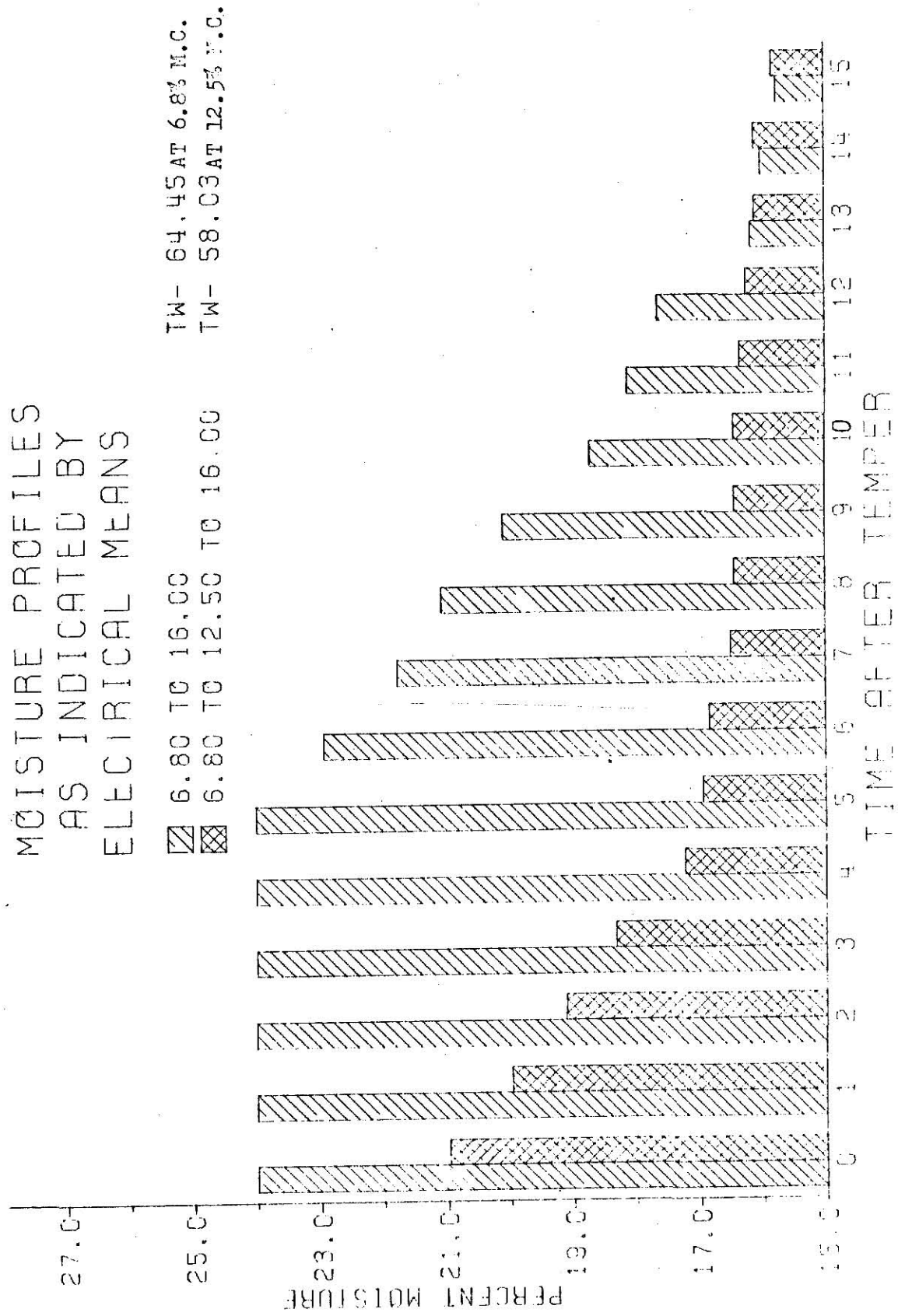


Figure 1. California Hard Red Winter Wheat one temper versus two temper by Totomco.

Table 3. California Hard Red Winter Wheat raised from 6.8 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	22.70	22.70+	22.70+
3	22.70	22.70+	22.70+
4	22.70	22.70+	22.70+
5	22.70	22.70+	22.70+
6	22.70	22.70+	22.70+
7	22.70	22.70+	22.70+
8	22.70	22.70+	22.70+
9	23.57	23.85	23.28
10	22.41	22.35	22.47
11	21.19	21.42	20.55
12	20.54	20.67	20.21
13	18.34	18.34	18.33
14	17.84	17.96	17.71
15	17.64	17.67	17.61

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 4. California Hard Red Winter Wheat raised from 6.8 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	23.40	22.86	23.94
2	21.64	21.48	21.80
3	20.46	20.34	20.58
4	19.42	19.62	19.21
5	19.00	18.99	19.00
6	18.75	18.71	18.79
7	18.71	18.57	18.84
8	18.45	18.41	18.49
9	18.33	18.24	18.42
10	18.28	18.34	18.21
11	18.14	17.99	18.28
12	18.03	17.92	18.14
13	17.80	17.83	17.76
14	17.61	17.65	17.57
15	17.47	17.46	17.48

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

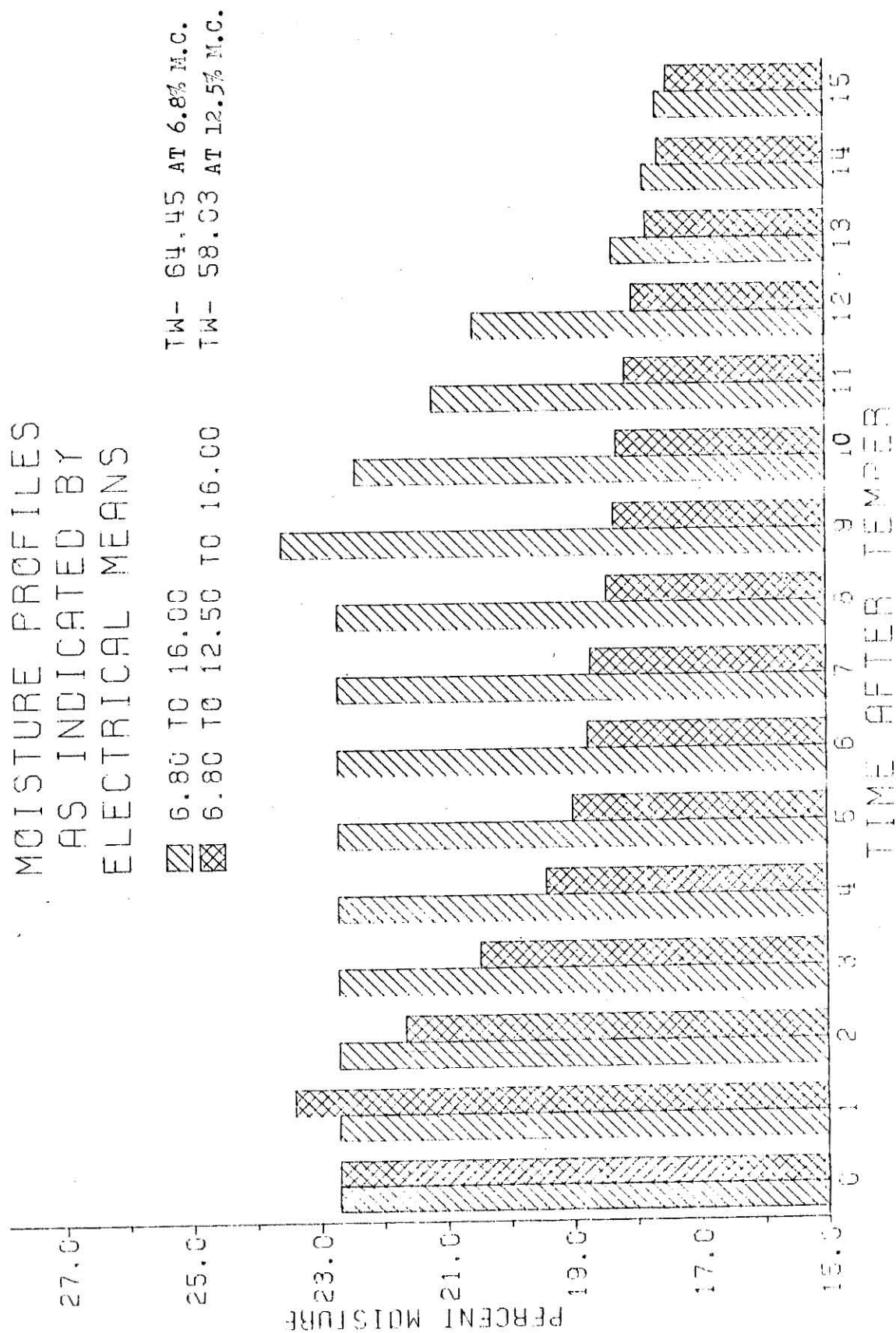


Figure 2. California Hard Red Winter Wheat one temper versus two temper by Steinlite.

Table 5. California Hard Red Winter Wheat raised from 6.8 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.10	24.10+	24.10+
4	24.10	24.10+	24.10+
5	24.10	24.10+	24.10+
6	24.10	24.10+	24.10+
7	24.10	24.10+	24.10+
8	24.10	24.10+	24.10+
9	24.10	24.10+	24.10+
10	24.10	24.10+	24.10+
11	23.62	23.63	23.60
12	22.92	22.93	22.90
13	18.38	18.28	18.47
14	17.36	17.34	17.37
15	17.09	16.98	17.19

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 6. California Hard Red Winter Wheat raised from 6.8 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	23.16	22.81	23.51
4	21.48	21.28	21.68
5	21.03	20.38	21.68
6	19.91	19.84	19.97
7	19.49	19.50	19.47
8	19.23	19.23	19.23
9	18.88	18.80	18.95
10	18.65	18.65	18.65
11	18.50	18.50	18.50
12	18.20	18.10	18.30
13	17.53	17.53	17.53
14	17.08	17.13	17.03
15	17.02	17.02	17.01

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



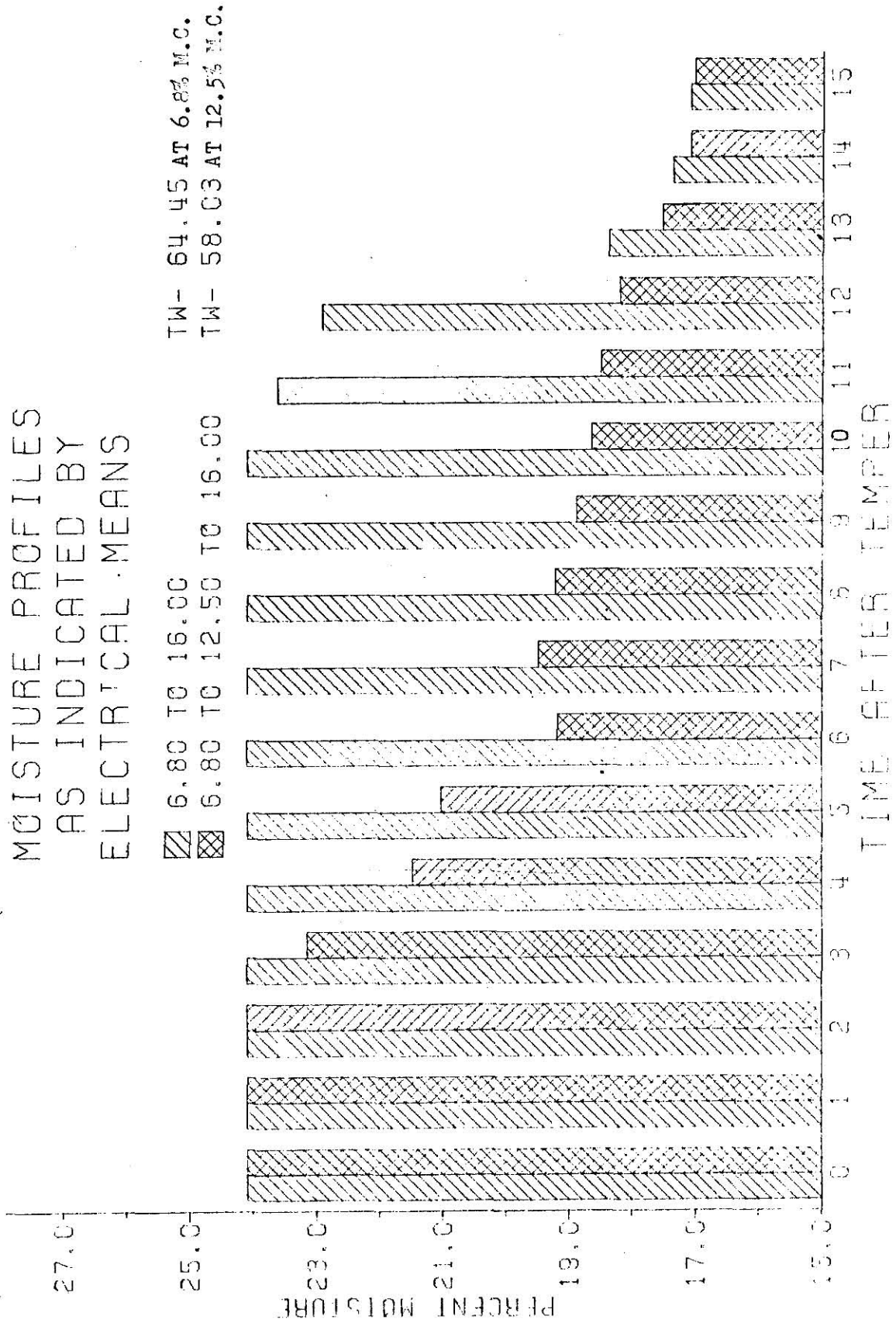


Figure 3. California Hard Red Winter Wheat one temper versus two temper by Tag-Iennenstall.

Table 7. California Hard Red Winter Wheat raised from 8.25 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	24.00	24.00+	24.00+
2	24.00	24.00+	24.00+
3	24.00	24.00+	24.00+
4	24.00	24.00+	24.00+
5	21.30	21.19	21.41
6	20.96	20.78	21.13
7	20.36	20.17	20.54
8	19.19	18.80	19.57
9	18.31	18.42	18.20
10	17.70	17.59	17.81
11	17.50	17.43	17.57
12	17.20	17.19	17.20
13	16.60	16.42	16.78
14	16.31	16.21	16.41
15	16.18	16.19	16.17

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 8. California Hard Red Winter Wheat raised from 8.25 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	19.98	19.83	20.12
1	19.00	19.09	18.90
2	17.93	17.91	17.94
3	17.24	17.33	17.14
4	16.75	16.75	16.75
5	16.55	16.54	16.56
6	16.35	16.54	16.16
7	16.26	16.35	16.16
8	16.20	16.23	16.15
9	16.15	16.13	16.16
10	16.15	16.13	16.16
11	16.13	16.13	16.13
12	16.13	16.13	16.13
13	16.18	16.19	16.18
14	16.03	16.02	16.03
15	15.96	15.92	15.99

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

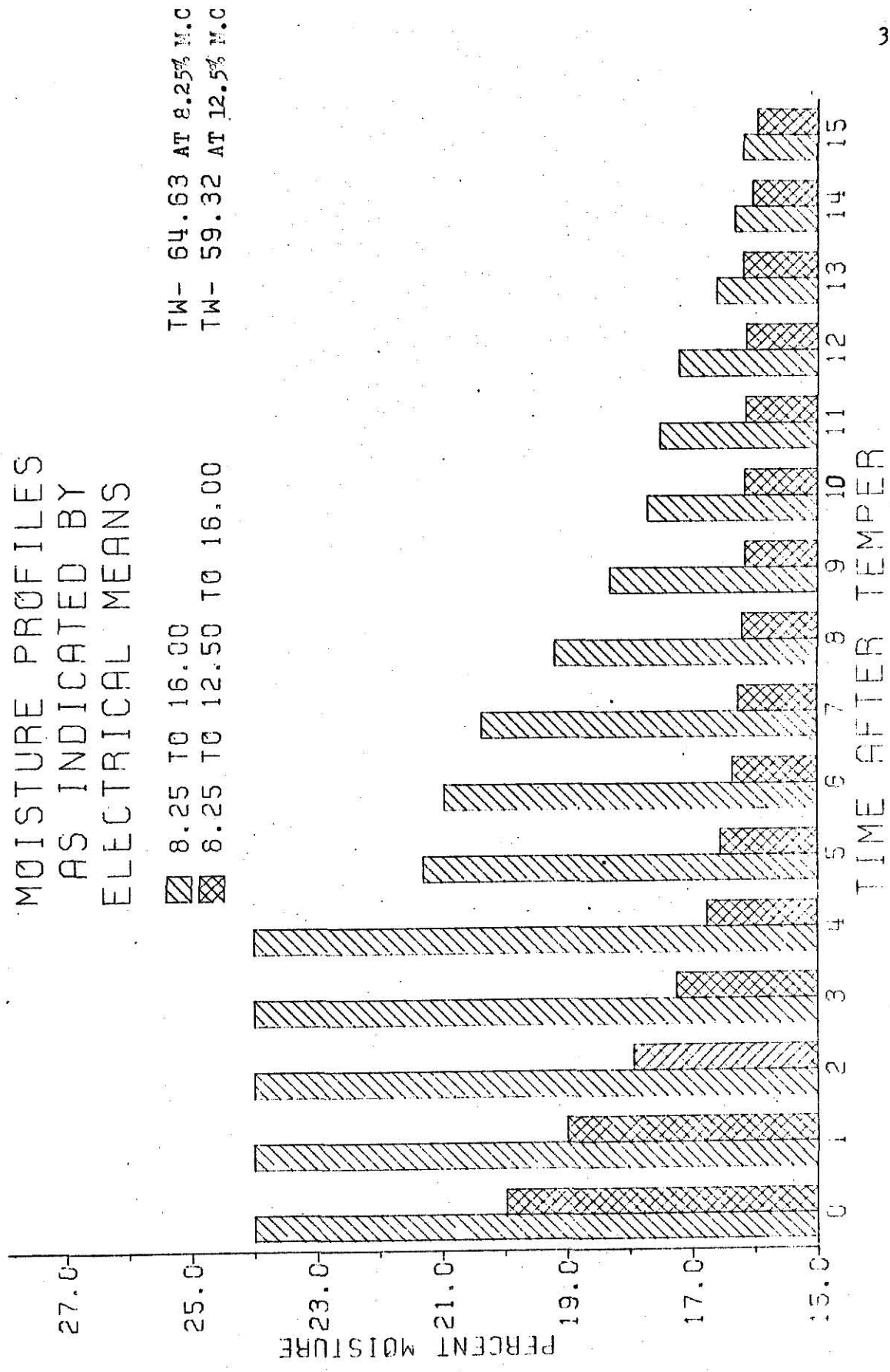


Figure 4. California Hard Red Winter Wheat one temper versus two temper by Motonco.

Table 9. California Hard Red Winter Wheat raised from 8.25 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	22.70	22.70+	22.70+
3	22.70	22.70+	22.70+
4	22.70	22.70+	22.70+
5	22.70	22.70+	22.70+
6	23.50	23.88	23.91
7	23.15	23.22	23.08
8	22.09	22.17	22.00
9	20.50	20.88	20.92
10	20.12	20.30	19.93
11	19.25	19.97	19.53
12	19.38	19.33	19.42
13	18.53	18.60	18.45
14	18.11	18.31	17.90
15	18.04	18.00	18.07

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 10. California Hard Red Winter Wheat raised from 8.25 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	23.52	23.47	24.37
1	21.54	21.49	21.59
2	20.13	20.29	19.96
3	19.88	19.92	19.84
4	19.33	19.34	19.32
5	18.82	18.76	18.90
6	18.77	18.86	18.67
7	18.79	18.76	18.81
8	18.70	18.55	18.81
9	18.69	18.56	18.81
10	18.63	18.66	18.60
11	18.46	18.38	18.54
12	18.55	18.59	18.50
13	18.56	18.64	18.48
14	18.35	18.66	18.04
15	19.24	18.28	18.15

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

8.25 TO 16.00  
 8.25 TO 12.50 TO 16.00

TW- 64.63 AT 8.25% M.C.  
 TW- 59.32 AT 12.5% M.C.

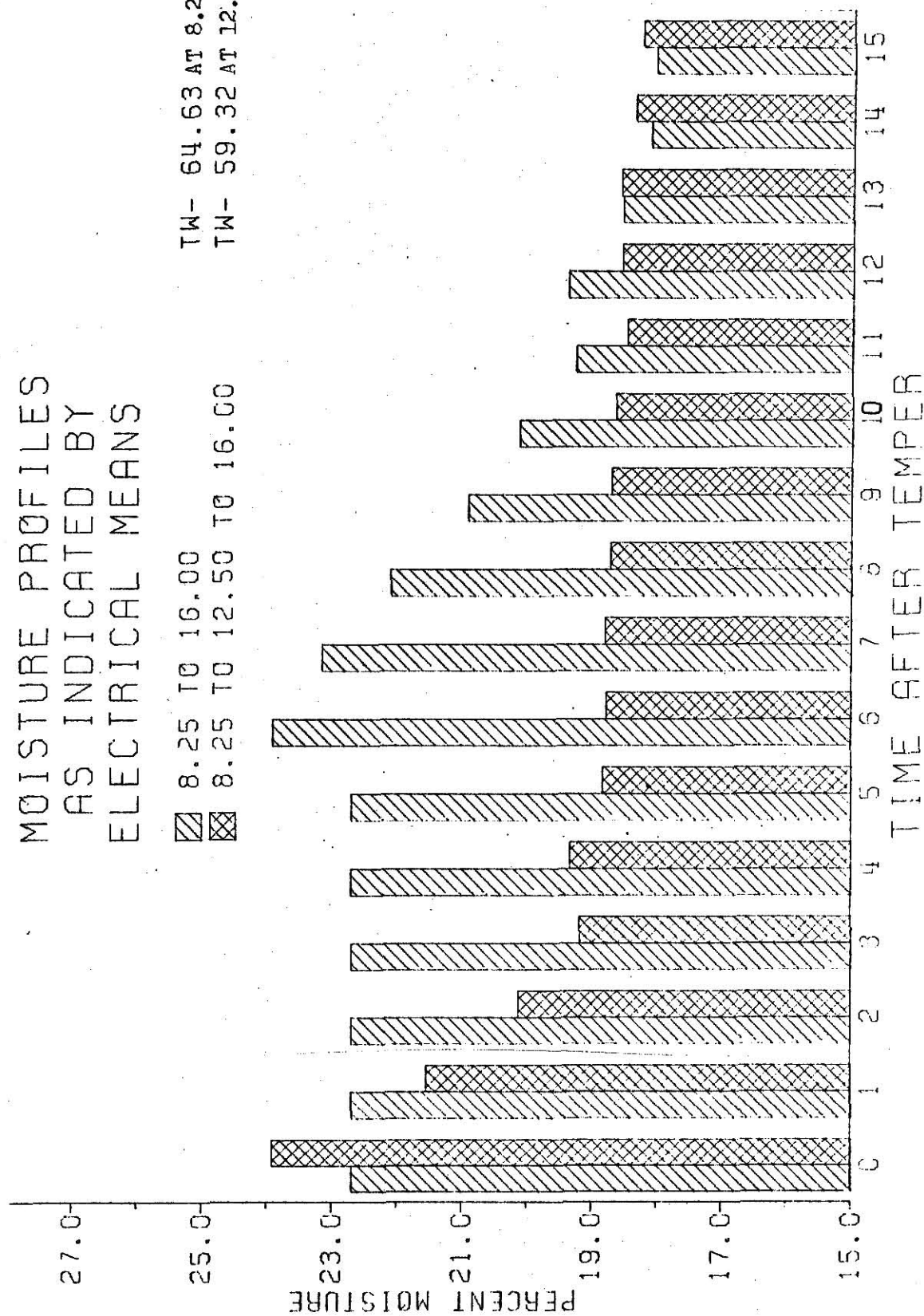


Figure 5. California Hard Red Winter Wheat one temper versus two temper by Steinlite.

Table 11. California Hard Red Winter Wheat raised from 8.25 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.10	24.10+	24.10+
4	24.10	24.10+	24.10+
5	24.10	24.10+	24.10+
6	24.10	24.10+	24.10+
7	24.10	24.10+	24.10+
8	24.10	24.10+	24.10+
9	24.10	24.10+	24.10+
10	23.72	23.72	23.72
11	21.89	21.92	21.86
12	21.00	20.86	21.13
13	18.22	18.16	18.28
14	16.69	16.65	16.73
15	16.09	16.05	16.13

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



Table 12. California Hard Red Winter Wheat raised from 8.25 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.48	24.53	24.43
2	22.92	22.93	22.90
3	21.25	21.40	21.10
4	20.29	20.36	20.22
5	19.67	19.73	19.60
6	19.08	19.03	19.08
7	18.63	18.63	18.63
8	18.22	18.23	18.20
9	17.88	18.01	17.75
10	17.77	17.78	17.75
11	17.57	17.57	17.57
12	17.38	17.38	17.38
13	16.88	16.93	16.83
14	16.43	16.39	16.46
15	16.20	16.23	16.16

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

 8.25 TO 16.00  
 8.25 TO 12.50 TO 16.00

TW- 64.63 AT 8.25% M.C.  
 TW- 59.32 AT 12.5% M.C.

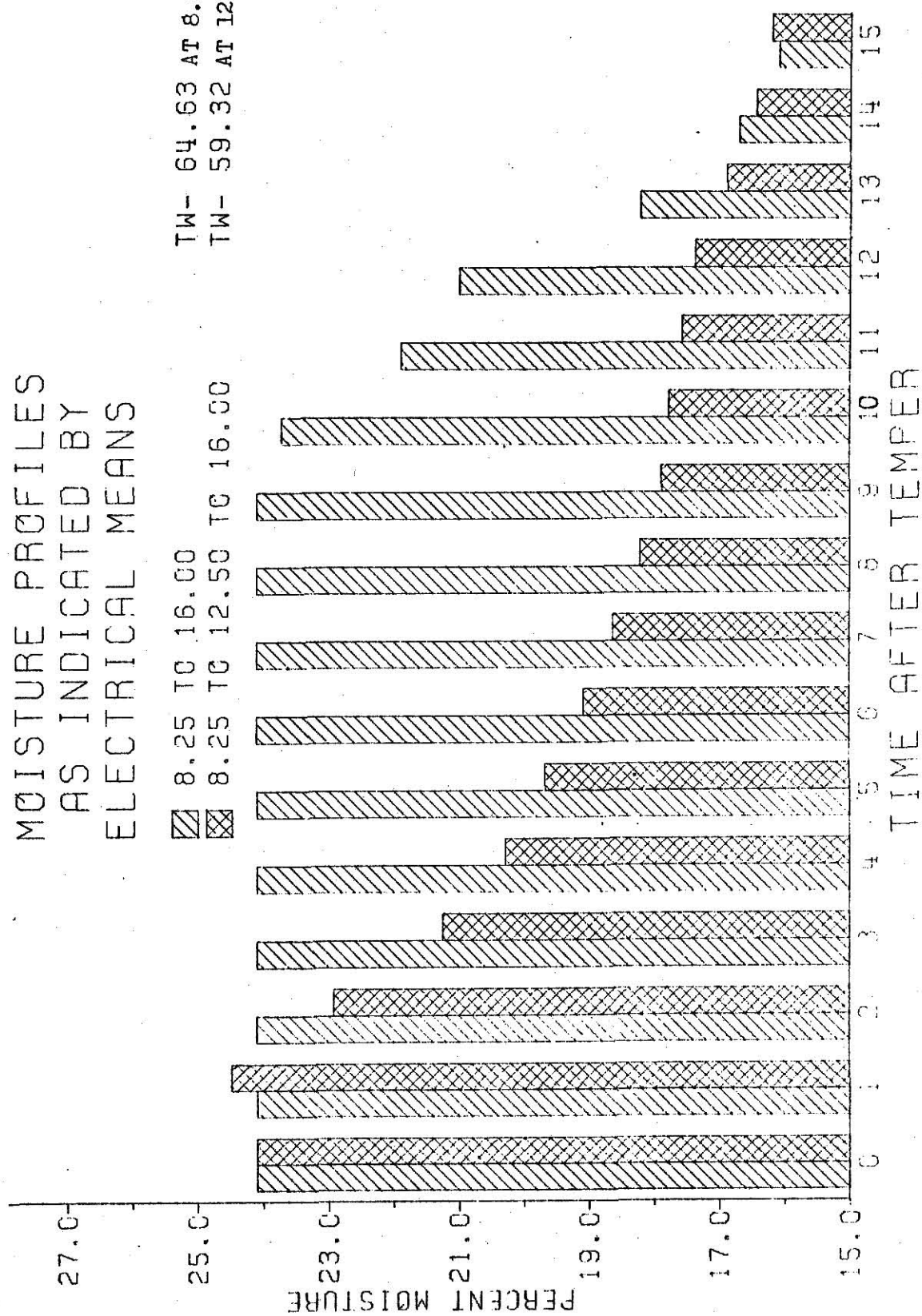


Figure 6. California Hard Red Winter Wheat one temper versus two temper by Tag-Heppenstall.

Table 13. Montana Hard Red Winter Wheat raised from 8.35 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	24.00	24.00+	24.00+
2	24.00	24.00+	24.00+
3	24.00	24.00+	24.00+
4	24.00	24.00+	24.00+
5	21.21	21.11	21.30
6	19.87	19.77	19.96
7	18.42	18.61	18.23
8	18.01	18.01	18.01
9	17.59	17.43	17.74
10	17.60	17.57	17.63
11	17.40	17.46	17.33
12	17.24	17.23	17.14
13	16.56	16.56	16.56
14	16.46	16.41	16.51
15	16.29	16.38	16.19

AN ASTERISK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 14. Montana Hard Red Winter Wheat raised from 8.35 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	19.48	20.46	19.49
2	18.61	18.51	18.70
3	17.92	18.13	17.71
4	17.18	17.33	17.02
5	16.97	17.02	16.92
6	16.88	16.92	16.84
7	16.73	16.73	16.73
8	16.73	16.73	16.73
9	16.72	16.73	16.70
10	16.61	16.70	16.51
11	16.51	16.51	16.51
12	16.51	16.51	16.51
13	16.42	16.47	16.37
14	16.16	16.06	16.26
15	16.09	16.18	15.99

AN ASTERISK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

8.35 TO 16.00  
 8.35 TO 12.50 TO 16.00  
 TW- 63.17 AT 8.35% M.C.  
 TW- 58.55 AT 12.5% M.C.

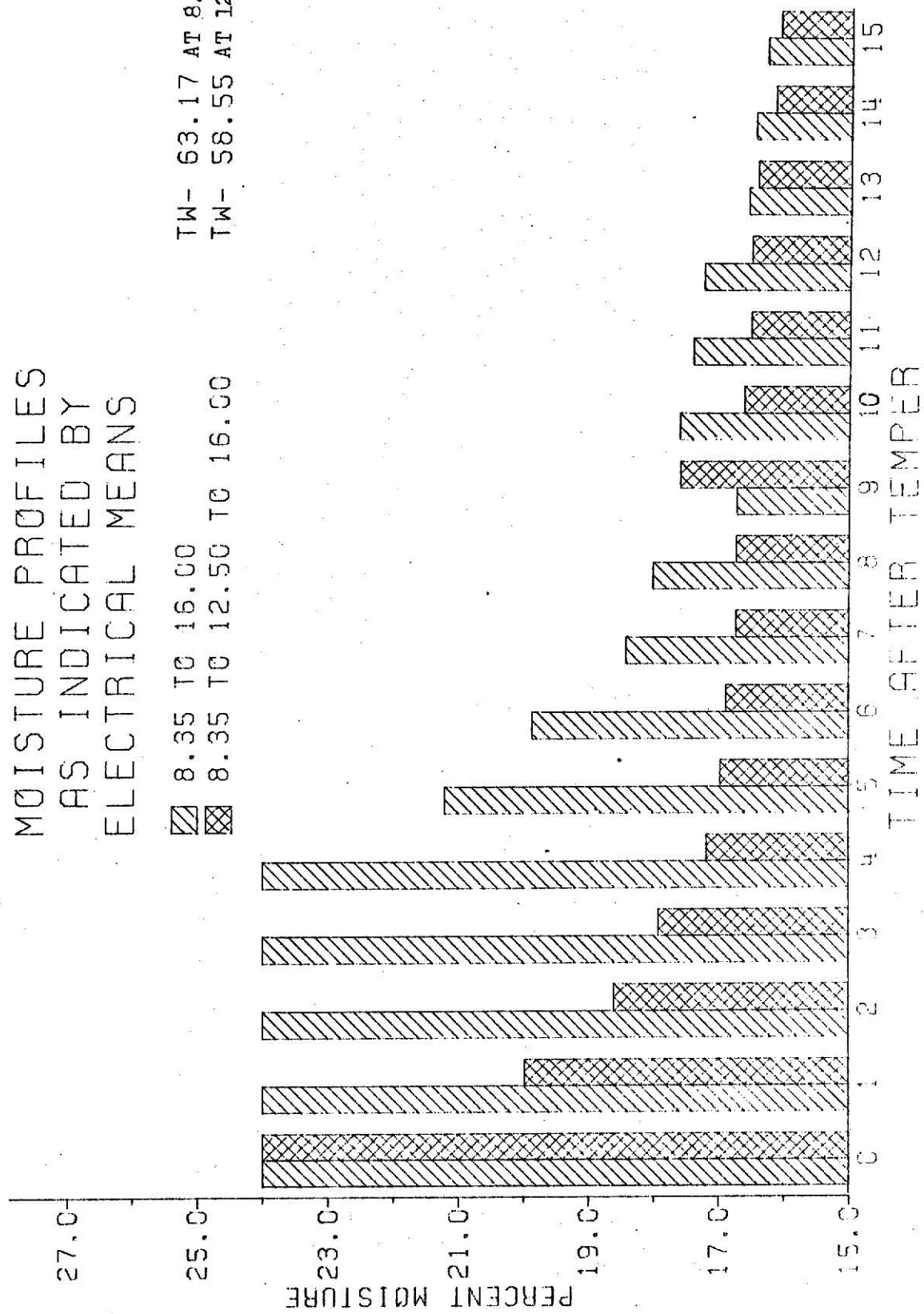


Figure 7. Montana Hard Red Winter Wheat one temper versus two temper by Motomco.

Table 15. Montana Hard Red Winter Wheat raised from 8.35 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	22.70	22.70+	22.70+
3	22.70	22.70+	22.70+
4	22.70	22.70+	22.70+
5	22.70	22.70+	22.70+
6	23.07	23.12	23.01
7	21.57	21.14	22.00
8	20.16	20.33	19.58
9	19.25	19.42	19.08
10	18.80	18.87	18.73
11	19.24	19.23	19.25
12	19.23	19.23	19.22
13	18.43	18.50	18.36
14	18.10	18.21	17.99
15	17.94	18.00	17.88

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 16. Montana Hard Red Winter Wheat raised from 8.35 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	23.55	23.94	23.16
2	21.67	21.97	21.37
3	20.61	20.62	19.40
4	19.54	19.26	19.72
5	19.56	19.84	19.28
6	19.38	19.81	19.24
7	19.29	19.20	19.38
8	19.38	19.27	19.38
9	19.19	19.09	19.28
10	18.86	19.06	18.86
11	19.14	19.13	19.14
12	18.88	19.17	18.79
13	18.78	18.94	18.62
14	18.87	18.74	18.99
15	18.63	18.68	18.58

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

8.35 TO 16.00

8.35 TO 12.50 TO 16.00

TW- 63.17AT 8.35% M.C.

TW- 58.55AT 12.5% M.C.

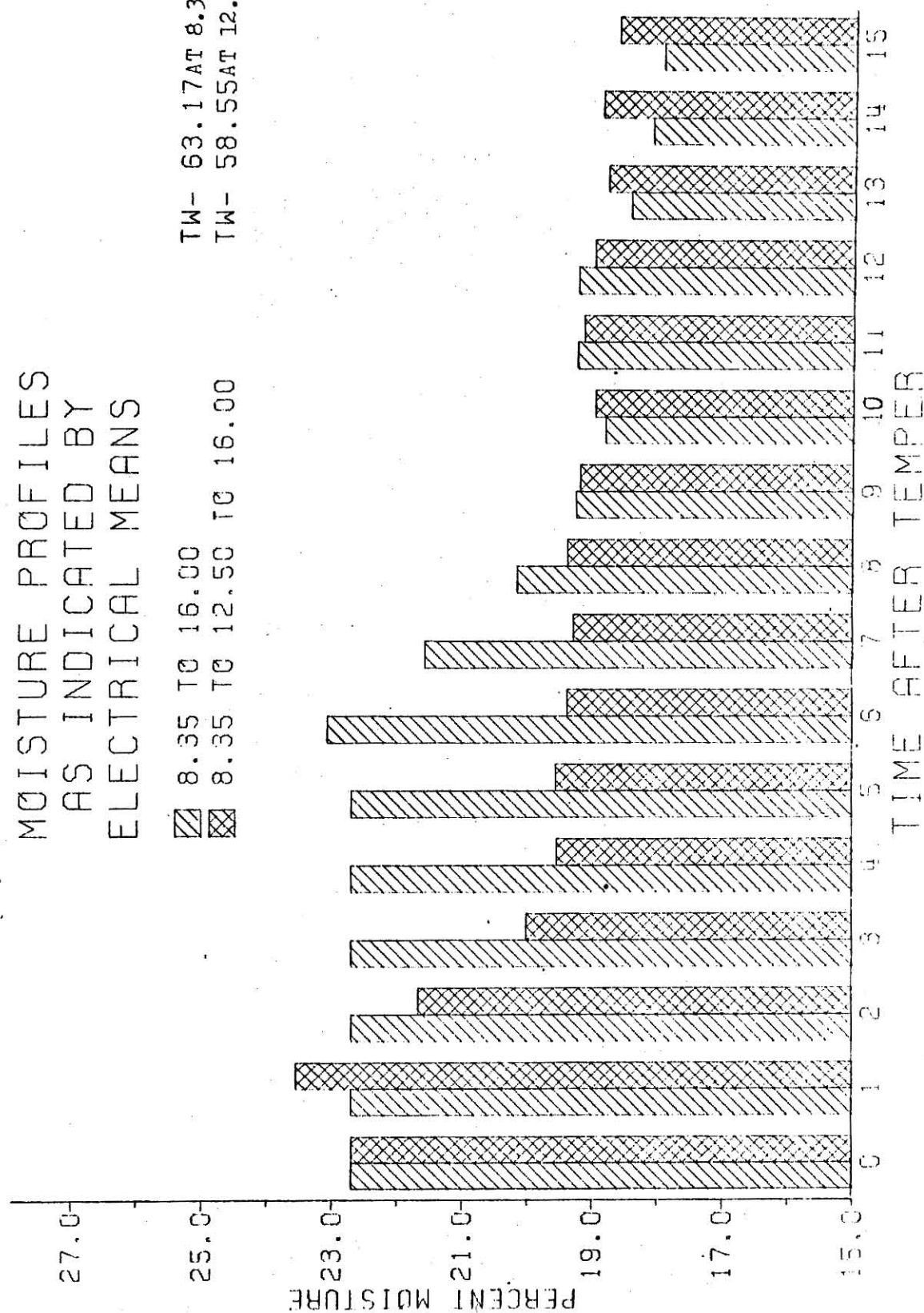


Figure 8. Montana Hard Red Winter Wheat one temper versus two temper by Steinlite.

Table 17. Montana Hard Red Winter Wheat raised from 8.35 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.10	24.10+	24.10+
4	24.10	24.10+	24.10+
5	24.10	24.10+	24.10+
6	24.10	24.10+	24.10+
7	24.48	24.40	24.55
8	22.72	22.42	23.02
9	21.33	21.52	21.13
10	20.27	20.28	20.25
11	19.78	19.76	19.80
12	19.51	19.51	19.51
13	17.71	17.62	17.80
14	16.35	16.26	16.43
15	16.15	16.15	16.15

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 18. Montana Hard Red Winter Wheat raised from 8.35 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	23.48	24.03	22.93
3	21.72	22.33	21.10
4	20.35	20.50	20.20
5	19.66	19.83	19.49
6	19.01	19.08	18.93
7	18.53	18.63	18.43
8	18.22	18.42	18.23
9	17.96	18.03	17.82
10	17.66	17.75	17.57
11	17.53	17.57	17.48
12	17.38	17.39	17.38
13	17.01	16.95	17.06
14	16.49	16.49	16.49
15	16.15	16.23	16.14

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

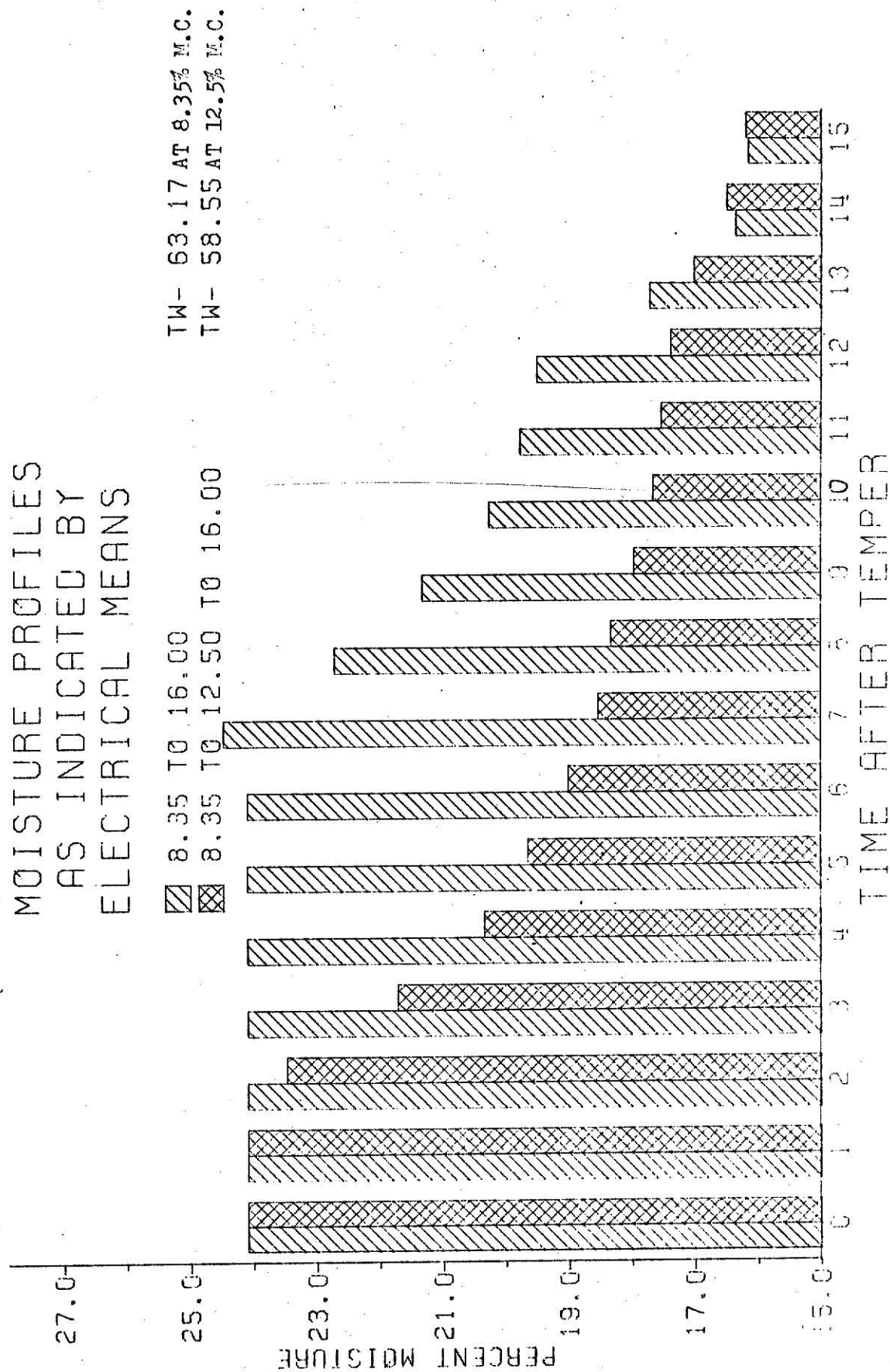


Figure 9. Montana Hard Red Winter Wheat one temper versus two temper by Tac-Illepenstall.

Table 19. California Hard Red Winter Wheat raised from 8.8 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	24.00	24.00+	24.00+
2	24.00	24.00+	24.00+
3	22.56	22.75	22.37
4	21.03	20.83	21.22
5	19.56	19.29	19.82
6	18.60	18.31	18.89
7	18.04	17.98	18.09
8	17.23	17.13	17.32
9	17.11	16.94	17.27
10	16.60	16.50	16.69
11	16.31	16.31	16.31
12	16.12	16.12	16.12

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 20. California Hard Red Winter Wheat raised from 8.8 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	19.91	19.81	20.00
1	18.26	18.43	18.08
2	17.19	17.28	17.09
3	16.51	16.51	16.51
4	16.30	16.30	16.30
5	16.11	16.11	16.11
6	16.08	16.08	16.08
7	16.08	16.08	16.08
8	16.07	16.08	16.05
9	16.05	16.05	16.05
10	16.05	16.05	16.05
11	16.04	16.05	16.03
12	16.03	16.03	16.03

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

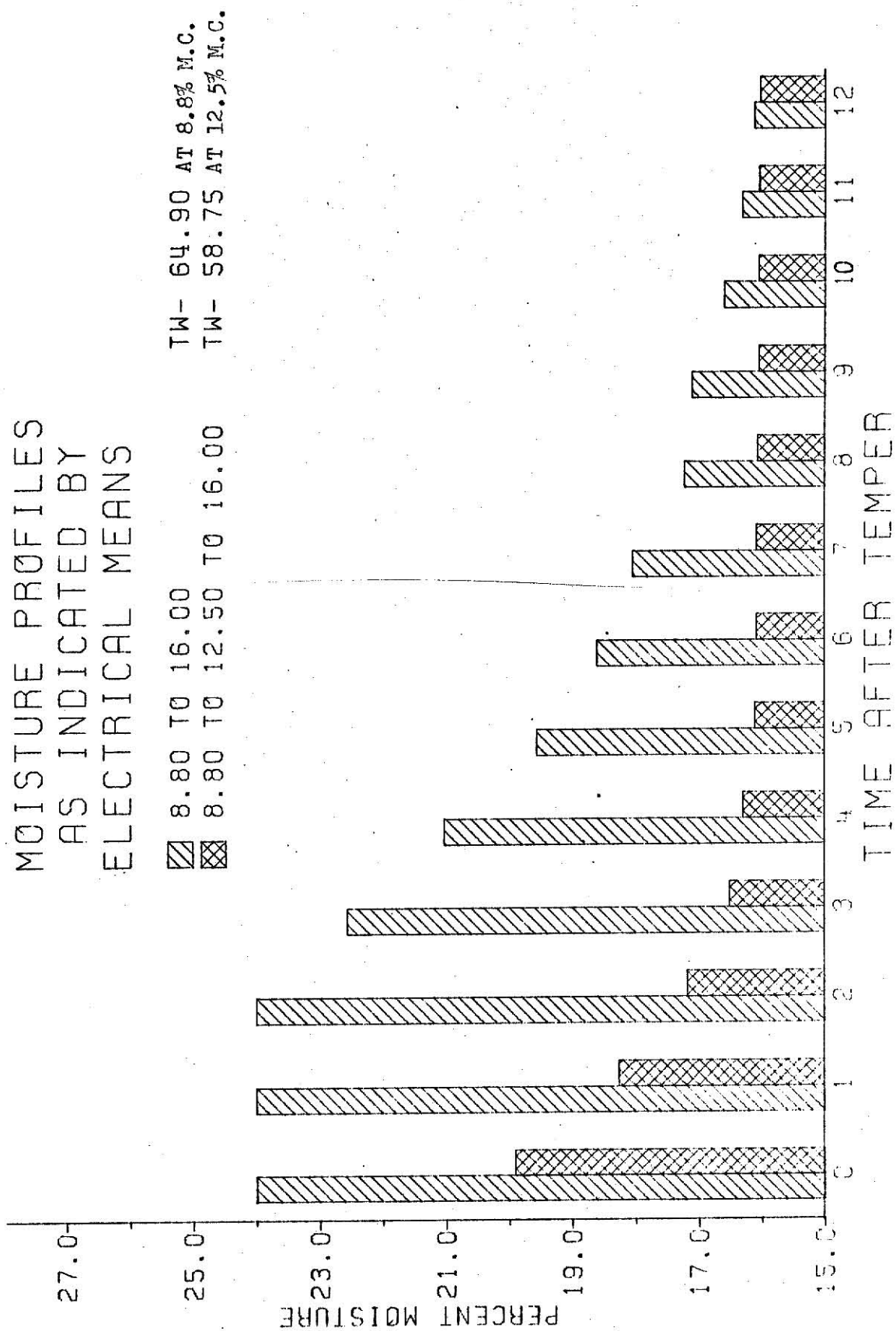


Figure 10. California Hard Red Winter Wheat one temper versus two temper by Notomco.

Table 21. California Hard Red Winter Wheat raised from 8.8 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	22.70	22.70+	22.70+
3	22.70	22.70+	22.70+
4	22.70	22.70+	22.70+
5	22.90	22.68	23.12
6	21.78	21.58	21.57
7	20.51	20.39	20.62
8	19.31	19.29	19.32
9	19.29	19.40	19.17
10	19.31	19.17	19.45
11	18.79	18.63	18.94
12	18.65	18.63	18.66

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 22. California Hard Red Winter Wheat raised from 8.8 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.75	23.26	22.24
1	22.64	20.94	24.34
2	19.04	19.08	18.99
3	19.24	19.34	19.14
4	18.73	18.93	18.52
5	18.34	18.30	18.38
6	18.10	18.06	18.14
7	18.17	18.27	18.07
8	17.81	17.78	17.84
9	17.77	17.69	17.84
10	17.73	17.62	17.84
11	17.60	17.38	17.81
12	17.60	17.59	17.60

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



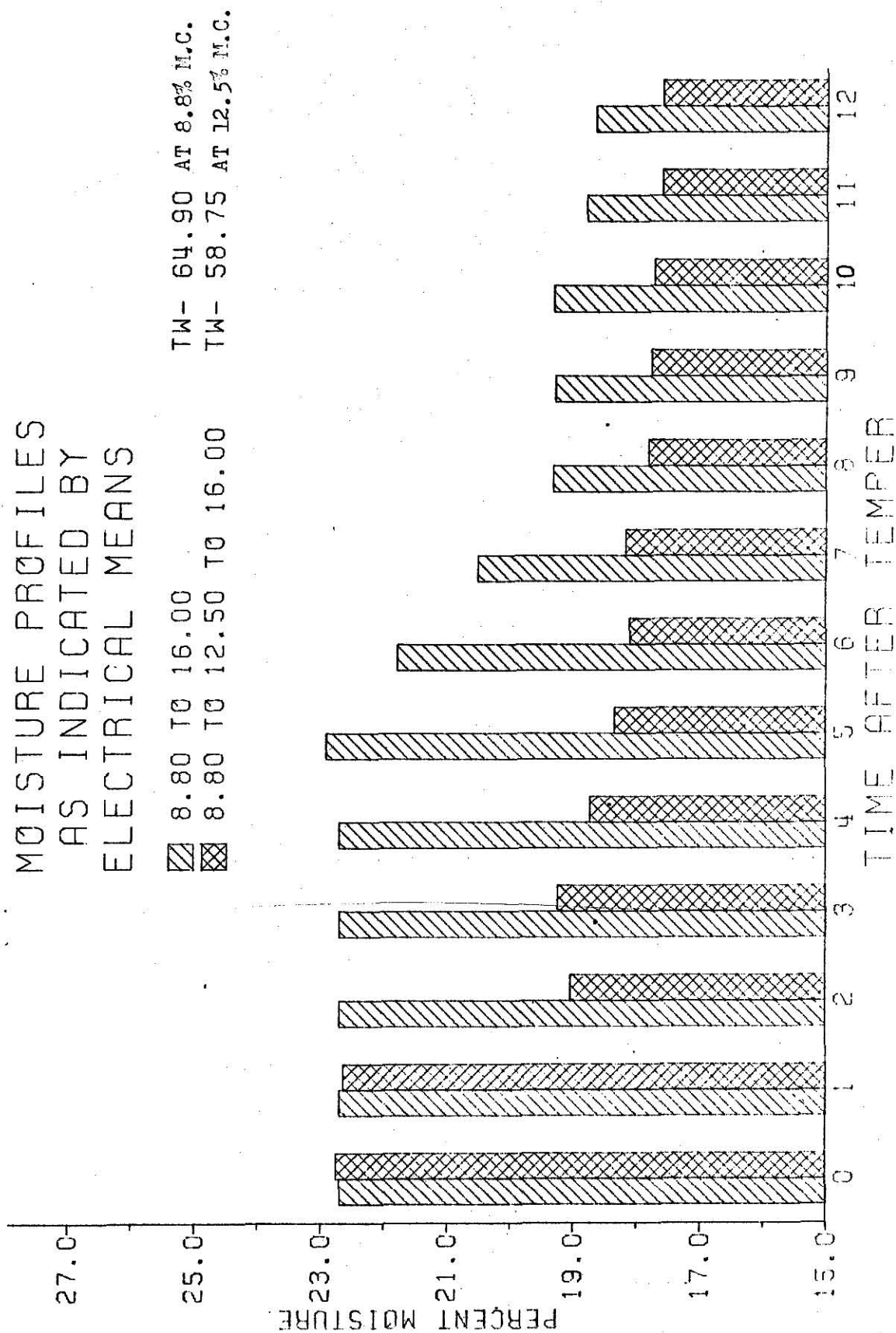


Figure 11. California Hard Red Winter Wheat one temper versus two temper by Steinlite.

Table 23. California Hard Red Winter Wheat raised from 8.8 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.10	24.10+	24.10+
4	24.10	24.10+	24.10+
5	24.10	24.10+	24.10+
6	24.19	24.19	24.19
7	22.66	22.66	22.66
8	21.16	21.16	21.16
9	20.53	20.26	20.80
10	20.02	19.58	20.06
11	19.55	19.43	19.66
12	19.32	19.21	19.43

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 24. California Hard Red Winter Wheat raised from 8.8 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	22.84	22.84	22.84
3	21.34	21.34	21.34
4	20.42	20.71	20.13
5	19.81	19.87	19.75
6	19.39	19.39	19.39
7	19.06	19.13	18.98
8	18.74	18.83	18.65
9	18.44	18.50	18.38
10	18.18	18.25	18.10
11	18.00	18.00	18.00
12	17.83	17.77	17.89

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

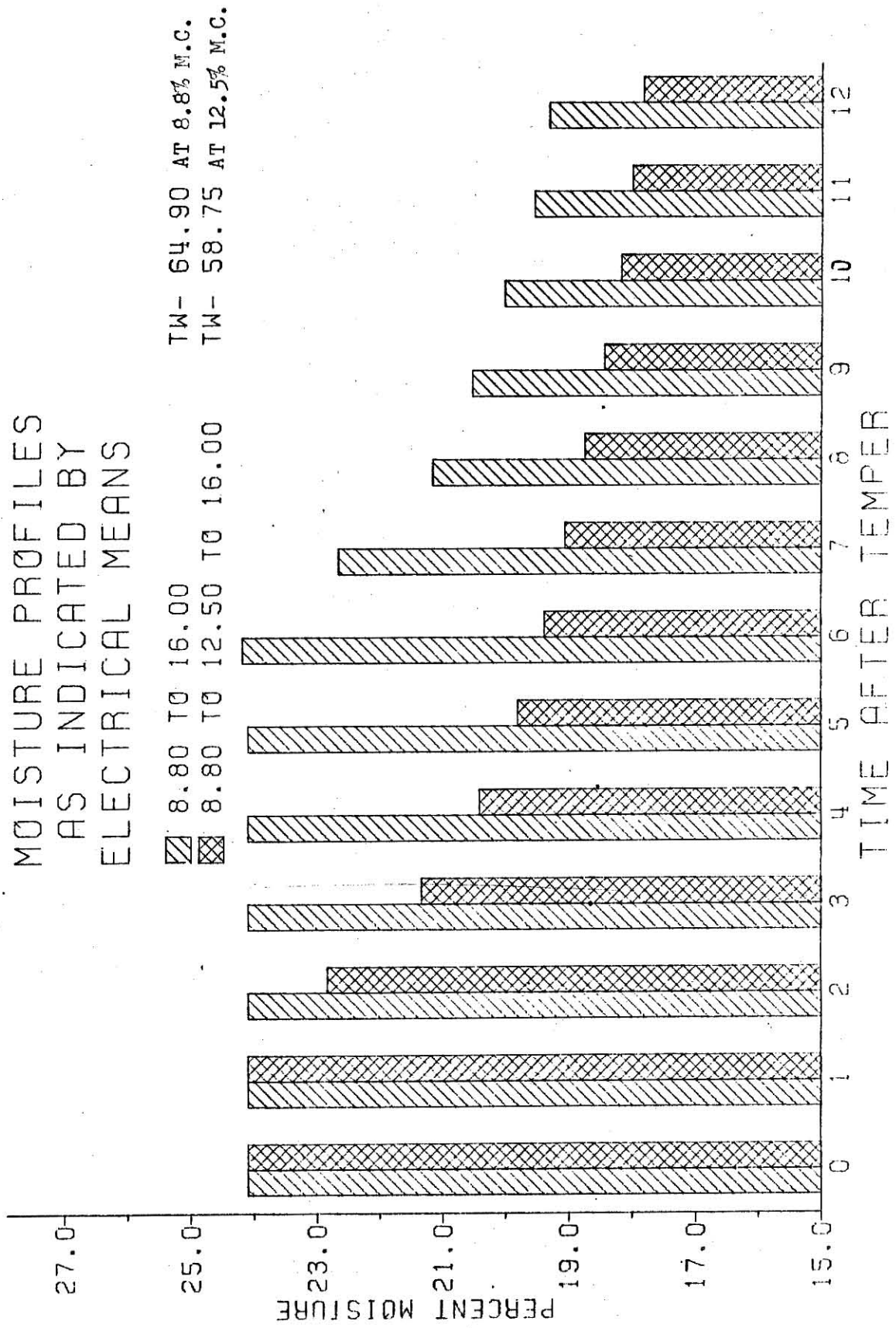


Figure 12. California Hard Red Winter Wheat one temper versus two temper by Tar-Heppenstall.

Table 25. Texas Hard Red Winter Wheat raised from 9.8 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	24.00	24.00+	24.00+
2	20.83	20.83	20.83
3	19.39	19.49	19.29
4	18.33	18.33	18.33
5	17.54	17.54	17.54
6	16.93	16.94	16.92
7	16.84	16.74	16.94
8	16.74	16.74	16.74
9	16.65	16.55	16.74
10	16.45	16.25	16.55
11	16.46	16.36	16.55
12	16.36	16.36	16.36

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 26. Texas Hard Red Winter Wheat raised from 9.8 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	19.04	19.23	18.85
1	17.70	17.89	17.50
2	17.10	17.31	16.89
3	16.80	16.70	16.89
4	16.59	16.68	16.49
5	16.49	16.49	16.49
6	16.48	16.46	16.49
7	16.46	16.46	16.46
8	16.46	16.46	16.46
9	16.27	16.27	16.27
10	16.27	16.27	16.27
11	16.27	16.27	16.27
12	16.08	16.08	16.08

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

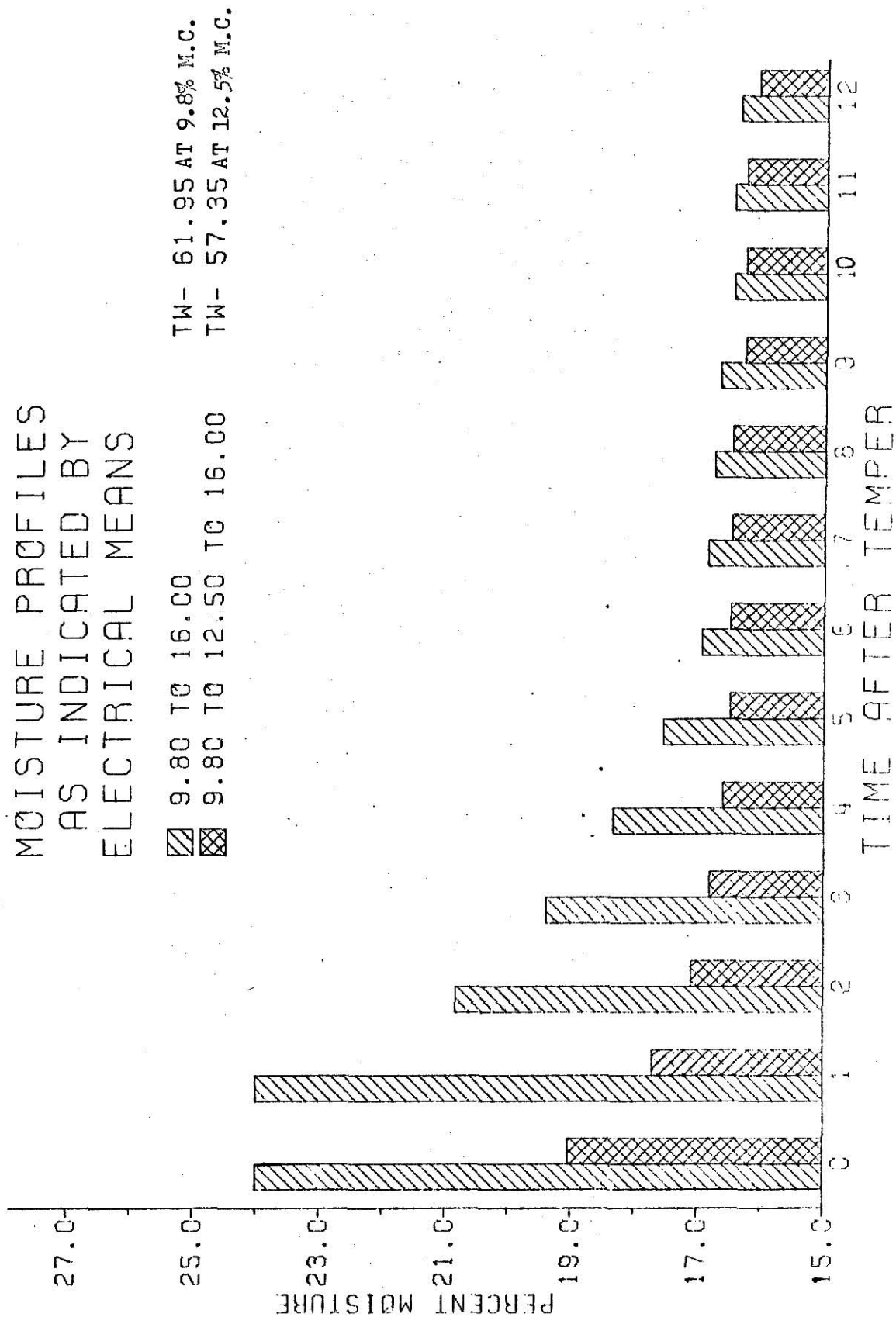


Figure 13. Texas Hard Red Winter Wheat one temper versus two temper by Motomco.

Table 27. Texas Hard Red Winter Wheat raised from 9.8 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	23.81	23.59	24.03
3	22.24	22.23	22.25
4	20.54	20.43	20.65
5	19.04	18.87	19.21
6	19.53	19.38	19.67
7	19.29	19.25	19.32
8	19.01	18.90	19.11
9	18.94	18.76	19.11
10	18.94	18.97	18.90
11	18.66	18.34	18.57

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 28. Texas Hard Red Winter Wheat raised from 9.8 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	21.60	21.61	21.59
1	19.51	19.81	19.21
2	19.32	19.22	19.42
3	19.02	18.91	19.12
4	18.47	18.75	18.19
5	18.30	18.40	18.19
6	18.25	18.37	18.12
7	18.20	18.37	18.02
8	18.13	18.23	18.02
9	18.02	18.02	18.02
10	18.02	18.02	18.02
11	17.88	17.88	17.88

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

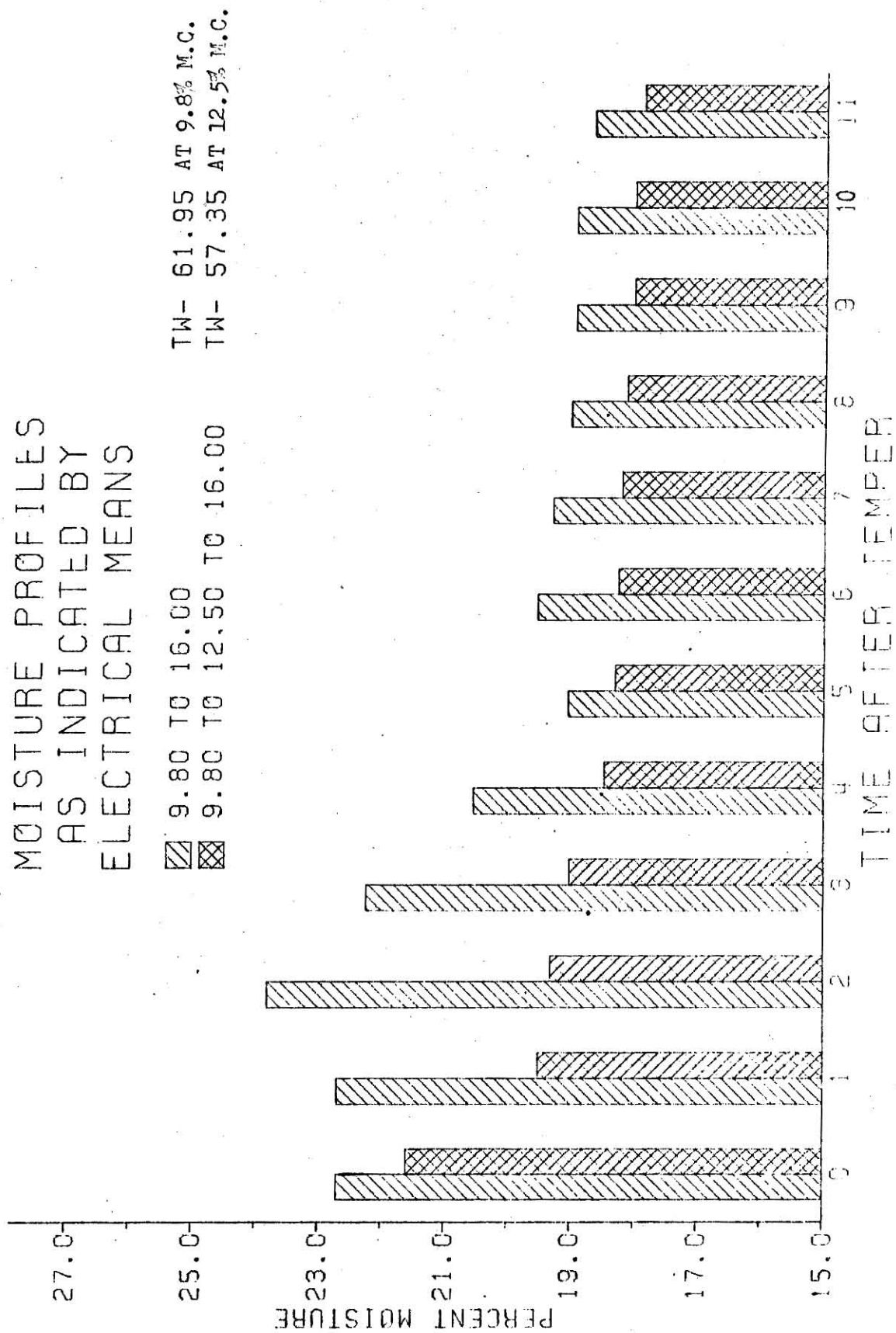


Figure 14. Texas Hard Red Winter Wheat one temper vs two temper by Stel-lite.

Table 29. Texas Hard Red Winter Wheat raised from 9.8 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	21.87	21.62	22.12
4	20.44	20.29	20.59
5	19.85	19.72	19.98
6	19.33	19.27	19.38
7	18.79	18.71	18.86
8	18.41	18.41	18.41
9	18.01	18.01	18.01
10	17.64	17.56	17.71
11	17.56	17.56	17.56
12	16.38	16.38	16.38

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 30. Texas Hard Red Winter Wheat raised from 9.8 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	21.82	22.27	21.37
2	21.32	20.19	22.44
3	19.67	19.67	19.67
4	18.94	19.01	18.86
5	18.56	18.56	18.56
6	18.27	18.13	18.41
7	17.72	17.68	17.76
8	17.53	17.50	17.56
9	17.31	17.31	17.31
10	17.19	17.25	17.13
11	17.13	17.13	17.13
12	16.94	16.94	16.94

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



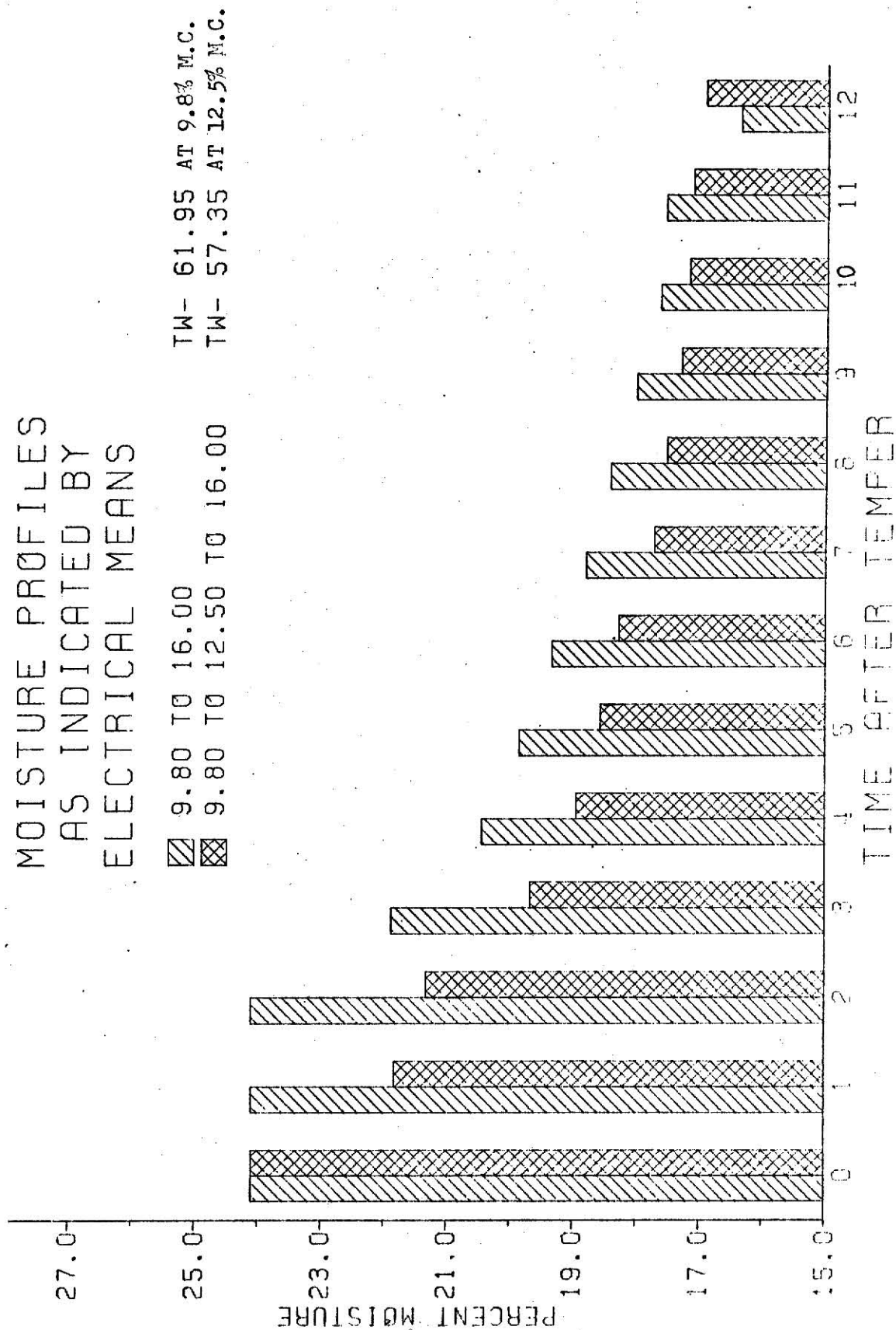


Figure 15. Texas Hard Red Winter wheat one temper versus two temper by Tag-Hepvenstall.

Table 31. Kansas Hard Red Winter Wheat raised from 10.8 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	20.73	21.01	20.44
2	20.44	20.62	20.25
3	19.39	19.66	19.12
4	18.95	19.22	18.68
5	18.46	19.01	17.91
6	17.82	18.02	17.62
7	17.34	17.54	17.14
8	17.25	17.44	17.05
9	17.13	17.14	17.12
10	17.05	17.04	17.05
11	17.05	17.04	17.05
12	17.05	17.04	17.05
13	16.82	16.68	16.96
14	16.58	16.53	16.63

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 32. Kansas Hard Red Winter Wheat raised from 10.8 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	20.66	20.50	20.81
1	19.48	19.70	19.25
2	18.47	19.03	17.90
3	18.29	18.72	17.86
4	17.88	18.14	17.62
5	17.61	17.92	17.29
6	17.50	17.92	17.08
7	17.11	17.13	17.08
8	17.09	17.13	17.05
9	16.99	16.94	17.03
10	17.02	17.10	16.94
11	17.01	17.08	16.94
12	17.01	17.08	16.94
13	16.74	16.94	16.53
14	16.68	16.87	16.48

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

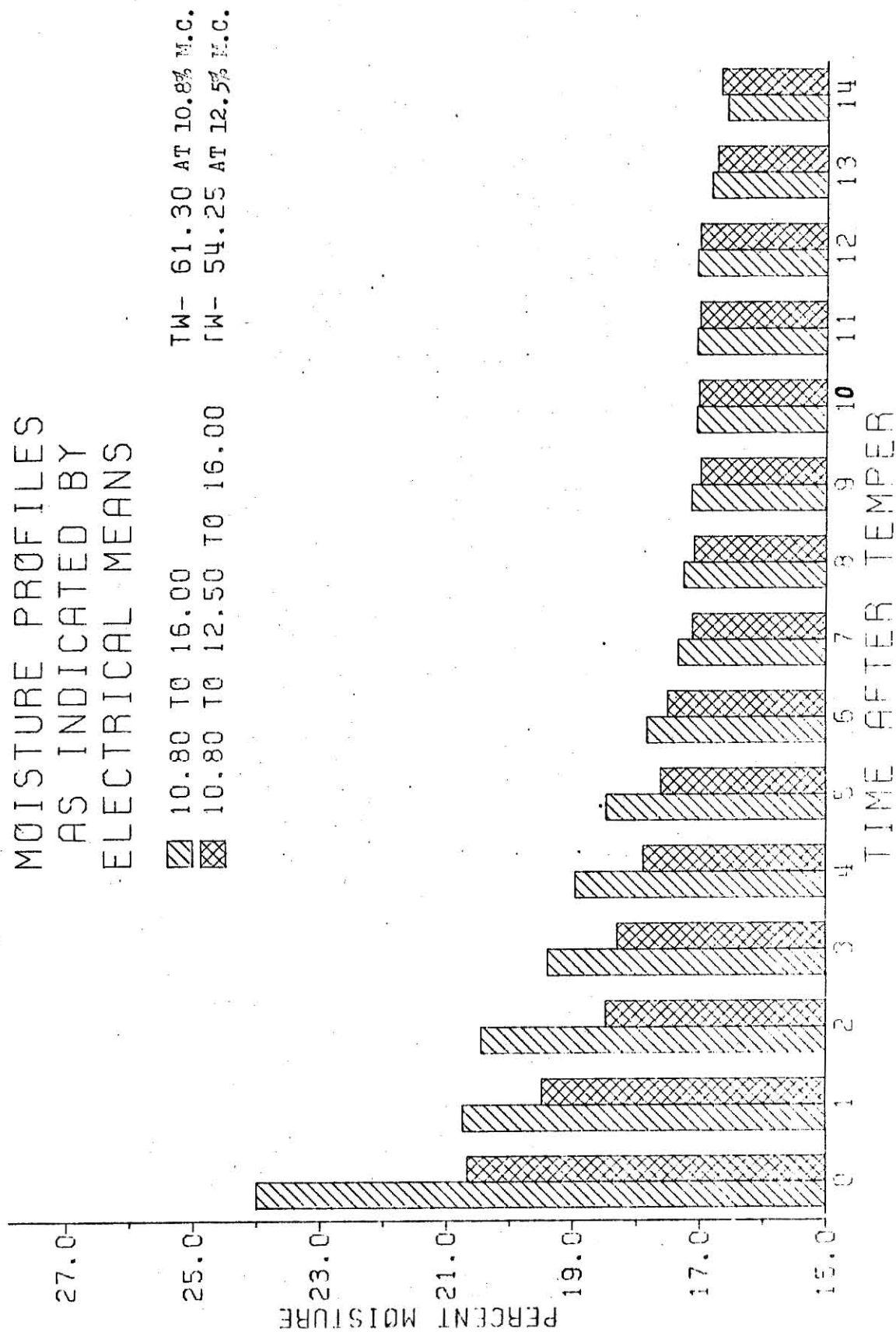


Figure 16. Kansas Hard Red Winter Wheat one temper versus two temper by Notonco.

Table 33. Kansas Hard Red Winter Wheat raised from 10.8 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.95	22.84	23.05
2	22.33	22.71	21.94
3	20.90	21.29	20.50
4	20.49	21.08	19.89
5	19.78	19.87	19.68
6	19.40	19.49	19.30
7	18.75	18.86	18.63
8	18.75	18.83	18.66
9	18.55	18.56	18.54
10	18.30	18.29	18.31
11	18.32	18.21	18.42
12	18.32	18.21	18.42
13	17.92	17.89	17.94
14	17.87	17.98	17.76

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 34. Kansas Hard Red Winter Wheat raised from 10.8 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.96	22.88	23.04
1	20.62	20.31	20.92
2	19.51	19.01	20.01
3	19.30	19.19	19.41
4	19.03	18.82	19.24
5	18.47	17.99	18.94
6	18.09	17.86	18.32
7	17.96	17.72	18.19
8	17.91	17.62	18.19
9	17.60	17.42	17.77
10	17.73	17.53	17.92
11	17.58	17.50	17.65
12	17.58	17.50	17.65
13	17.46	17.18	17.74
14	17.41	17.23	17.58

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

MOISTURE PROFILES  
AS INDICATED BY  
ELECTRICAL MEANS

TW- 61.30 AT 10.8% M.C.  
TW- 54.25 AT 12.5% M.C.

10.80 TO 16.00  
10.80 TO 12.50 TO 16.00

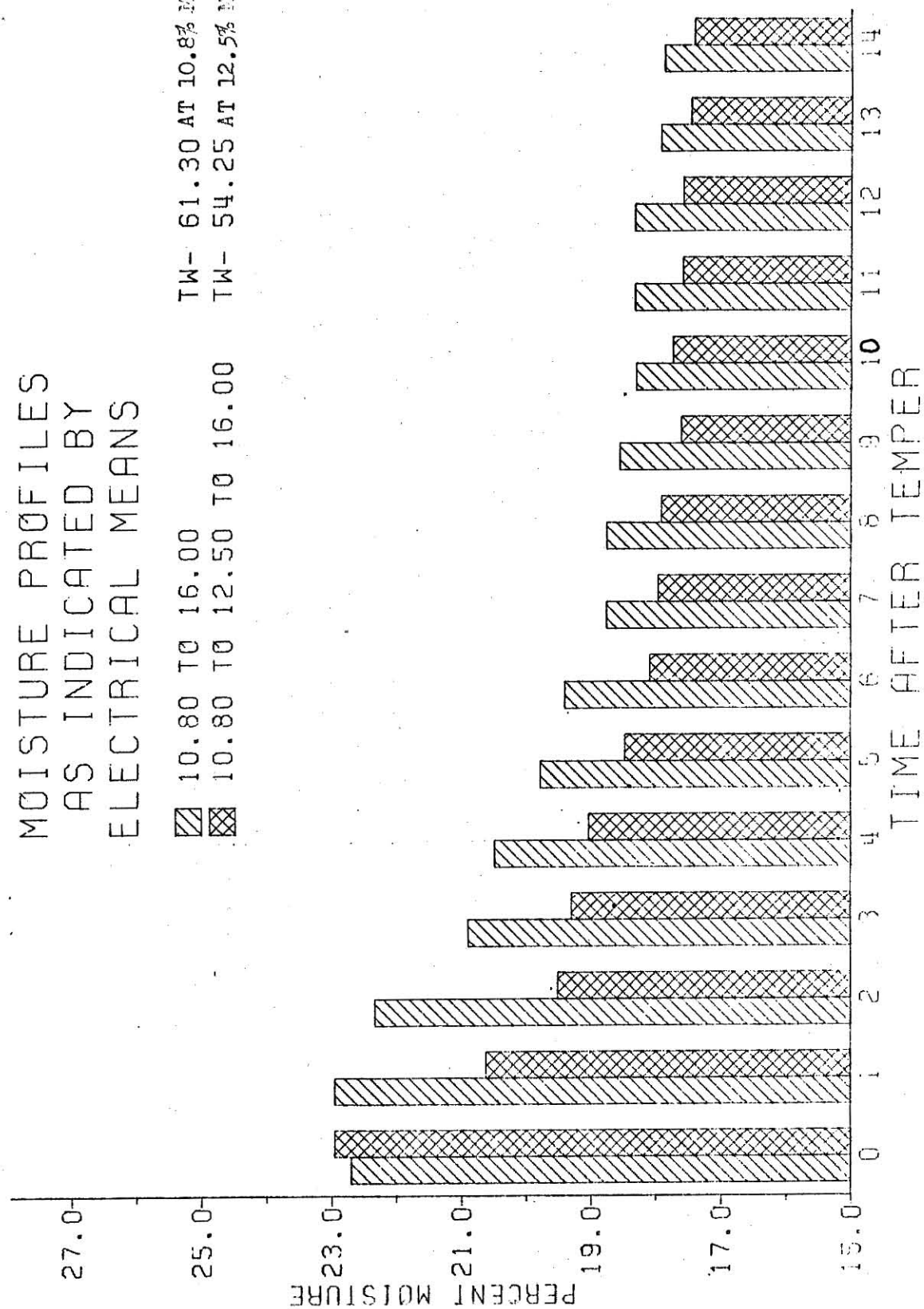


Figure 17. Kansas Hard Red Winter wheat one temper versus two temper by Steinlite.

Table 35. Kansas Hard Red Winter Wheat raised from 10.8 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.51	25.12	23.90
4	23.23	23.91	22.54
5	21.91	22.48	21.34
6	20.80	21.40	20.20
7	20.22	20.62	19.62
8	19.84	20.33	19.34
9	19.39	19.82	18.96
10	18.93	19.37	18.49
11	18.65	19.02	18.27
12	18.21	18.64	17.77
13	16.57	16.65	16.48
14	16.19	16.20	16.18

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 36. Kansas Hard Red Winter Wheat raised from 10.8 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.70	24.94	24.45
2	23.65	24.54	22.75
3	22.26	22.81	21.70
4	21.43	21.91	20.95
5	20.57	20.98	20.15
6	20.02	20.44	19.59
7	19.37	19.70	19.04
8	19.01	19.40	18.61
9	18.73	19.10	18.36
10	18.30	18.75	17.85
11	18.05	18.42	17.67
12	17.89	18.19	17.58
13	16.54	16.70	16.38
14	16.34	16.43	16.25

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

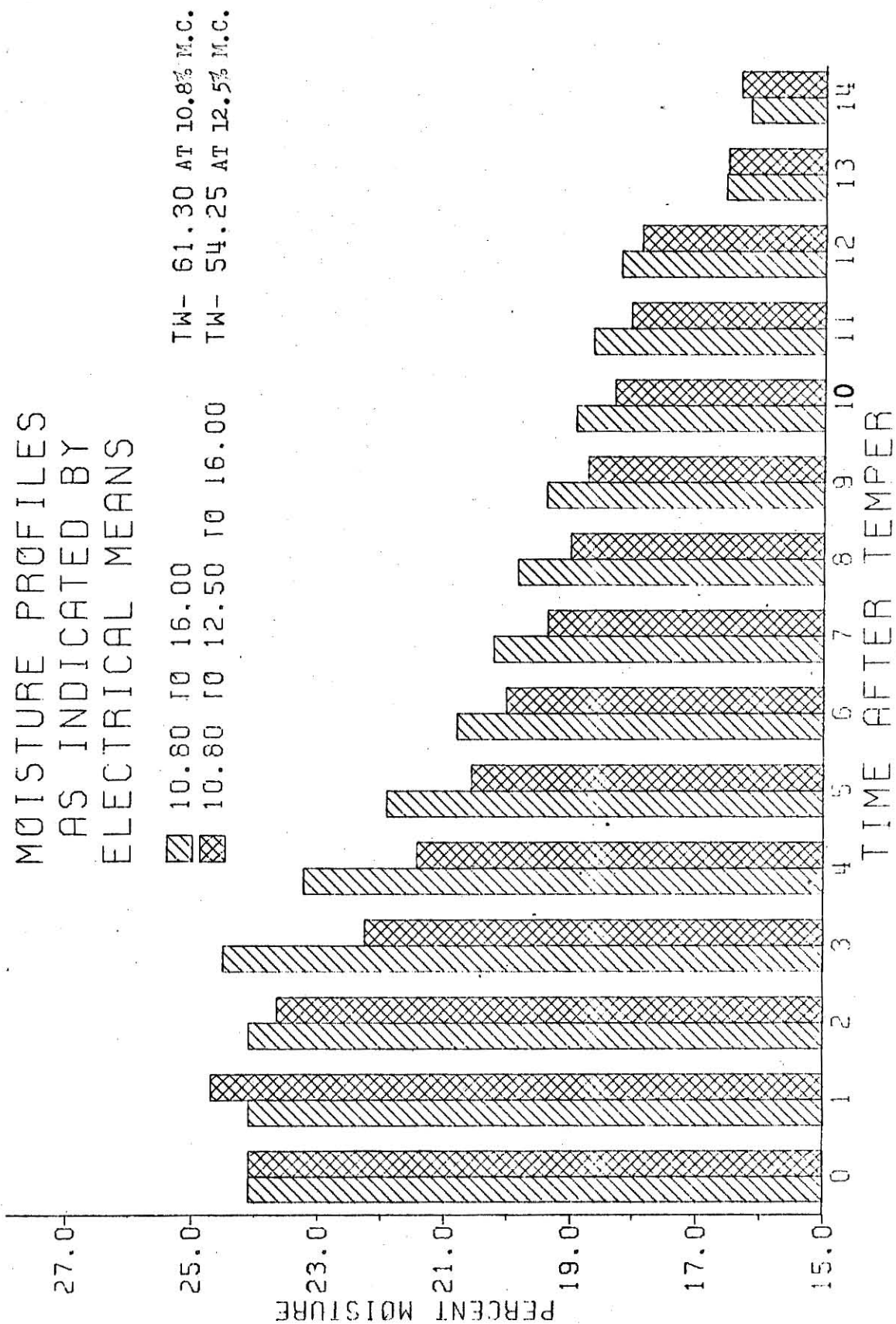


Figure 18. Kansas Hard Red Winter Wheat one temper versus two temper by Tag-Heppenstall.

different area of the country. These wheats were not received in sufficient quantities to evaluate the one temper versus two temper testing.

Matz (40) found that it was necessary to temper in successive steps since it was difficult to add more than a few per cent of water at one time. This statement is supported when observing the graphs for all of the tested grains and not just for wheat.

Figures 19, 20 and 21 show that wheat which has been scoured does increase in rate of water penetration. This was evident for all three moisture meters. The one temper (scoured) wheat was faster in rate of water penetration than was the two temper (unscoured) wheat. The graphs (Figures 19, 20 and 21) also show the two temper to have a faster rate of water penetration than for the one temper.

Soft Red Winter Wheat. Results in testing the Soft Red Winter Wheat are presented in Tables 55 through 60. The one temper versus the two temper are shown in Figures 22, 23 and 24. The two temper had a significantly greater rate of water penetration than for the one temper for each of the moisture meters.

Durum Wheat. Results in testing the Durum Wheat are presented in Tables 61 through 66. The one temper versus the two temper are shown in Figures 25, 26 and 27. There was a significantly greater rate of water penetration for the two temper over the one temper for each of the moisture meters.

Western White Wheat. Results in testing the Western White Wheat are presented in Tables 67 through 72. The one temper versus the two temper are shown in Figures 28, 29 and 30. The two temper had a significant increase in rate of water penetration for each of the moisture testers.



Table 37. Hard Red Winter Wheat (Cajeme) raised from 7.1 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	24.00	24.00+	24.00+
2	24.00	24.00+	24.00+
3	24.00	24.00+	24.00+
4	24.00	24.00+	24.00+
5	24.00	24.00+	24.00+
6	22.47	21.99	22.95
7	21.22	21.61	20.82
8	20.24	20.24	20.24
9	19.16	18.88	19.44
10	18.58	18.67	18.48
11	18.00	18.10	17.89
12	17.20	17.31	17.09
13	16.44	16.37	16.51
14	16.26	16.28	16.23
15	16.20	16.23	16.17

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 38. Hard Red Winter Wheat (Cajeme) raised from 7.1 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	22.70	22.70+	22.70+
3	22.70	22.70+	22.70+
4	22.70	22.70+	22.70+
5	22.70	22.70+	22.70+
6	22.70	22.70+	22.70+
7	22.70	22.70+	22.70+
8	22.70	22.70+	22.70+
9	23.67	23.63	23.71
10	22.65	22.70+	22.60
11	21.37	21.21	21.52
12	20.21	19.98	20.44
13	18.72	18.99	18.44
14	18.17	18.39	17.94
15	17.99	18.17	17.81

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 39. Hard Red Winter Wheat (Cajeme) raised from 7.1 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.10	24.10+	24.10+
4	24.10	24.10+	24.10+
5	24.10	24.10+	24.10+
6	24.10	24.10+	24.10+
7	24.10	24.10+	24.10+
8	24.10	24.10+	24.10+
9	24.10	24.10+	24.10+
10	24.10	24.10+	24.10+
11	24.10	24.10+	24.10+
12	23.21	22.84	23.57
13	19.35	19.45	19.25
14	17.75	17.86	17.64
15	17.27	17.28	17.25

AN ASTRIC IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 40. Hard Red Winter Wheat (Texas) raised from 10.0 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	24.00	24.00+	24.00+
2	21.71	21.71	21.71
3	20.74	20.75	20.73
4	19.95	19.96	19.93
5	19.26	19.54	18.97
6	18.67	18.58	18.75
7	17.97	17.79	18.15
8	17.57	17.57	17.57
9	17.48	17.38	17.57
10	17.28	17.19	17.36
11	17.36	17.36	17.36
12	17.17	17.17	17.17
13	17.05	16.71	17.38
14	16.74	16.74	16.74
15	16.83	16.81	16.84

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 41. Hard Red Winter Wheat (Texas) raised from 10.0 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	22.70	22.70+	22.70+
3	24.21	24.46	23.56
4	23.19	23.51	22.87
5	21.90	22.16	21.64
6	20.48	20.68	20.28
7	19.51	19.56	19.45
8	19.77	20.03	19.50
9	19.86	20.00	19.72
10	19.56	19.70	19.42
11	19.55	19.40	19.70
12	19.45	19.40	19.49
13	19.05	18.65	19.44
14	19.11	18.92	19.29
15	18.86	18.92	18.80

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 42. Hard Red Winter Wheat (Texas) raised from 10.0 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.10	24.10+	24.10+
4	24.10	24.10+	24.10+
5	23.37	23.72	23.02
6	22.16	22.42	21.89
7	21.03	21.19	20.86
8	20.22	20.42	20.02
9	19.85	19.91	19.79
10	19.43	19.57	19.28
11	18.98	18.98	18.98
12	18.76	18.83	18.68
13	17.45	17.31	17.58
14	17.16	17.16	17.16
15	16.72	16.70	16.73

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 43. Hard Red Winter Wheat (Inia) raised from 8.0 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	24.00	24.00+	24.00+
2	24.00	24.00+	24.00+
3	22.91	23.00	22.81
4	21.92	22.04	21.80
5	21.30	21.22	21.37
6	20.82	20.46	21.17
7	19.72	20.02	19.42
8	18.82	18.82	18.82
9	18.04	17.66	18.41
10	17.95	17.86	18.03
11	17.63	17.45	17.81
12	17.44	17.26	17.61
13	16.89	16.89	16.89
14	17.02	17.04	16.99
15	16.38	16.38	16.38

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 44. Hard Red Winter Wheat (Inia) raised from 8.0 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	22.70	22.70+	22.70+
3	22.70	22.70+	22.70+
4	22.70	22.70+	22.70+
5	22.70	22.70+	22.70+
6	22.70	22.70+	22.70+
7	23.18	22.99	23.37
8	22.09	21.62	22.55
9	21.29	20.92	21.66
10	20.65	20.38	20.92
11	19.93	19.66	20.19
12	19.45	19.21	19.69
13	19.17	18.89	19.44
14	18.87	18.90	18.84
15	18.26	18.27	18.25

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 45. Hard Red Winter Wheat (Inia) raised from 8.0 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.10	24.10+	24.10+
4	24.10	24.10+	24.10+
5	24.10	24.10+	24.10+
6	24.10	24.10+	24.10+
7	24.10	24.10+	24.10+
8	23.54	23.54	23.54
9	22.23	22.24	22.21
10	21.43	21.34	21.51
11	20.47	20.41	20.53
12	20.12	20.13	20.10
13	18.08	17.97	18.19
14	17.37	17.27	17.36
15	16.86	16.86	16.86

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 46. Hard Red Winter Wheat (Idaho) raised from 10.0 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	22.94	22.84	23.03
2	21.87	22.04	21.69
3	21.18	21.66	20.70
4	19.88	19.88	19.88
5	19.21	19.49	18.92
6	18.62	18.53	18.70
7	18.40	18.51	18.29
8	18.20	18.10	18.29
9	17.62	17.52	17.71
10	17.62	17.71	17.52
11	17.37	17.52	17.22
12	17.31	17.31	17.31
13	17.01	16.99	17.02
14	17.14	17.04	17.24
15	17.22	17.09	17.34

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 47. Hard Red Winter Wheat (Idaho) raised from 10.0 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	22.70	22.70+	22.70+
2	24.10	24.16	24.03
3	23.16	23.18	23.13
4	22.13	22.37	21.88
5	21.19	21.47	20.90
6	20.07	20.16	19.98
7	19.45	19.49	19.40
8	19.57	20.00	19.93
9	19.79	19.94	19.63
10	19.70	19.70	19.69
11	19.14	18.67	19.61
12	19.71	19.62	19.79
13	19.04	18.85	19.22
14	18.76	18.62	18.89
15	18.60	18.53	18.67

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 48. Hard Red Winter Wheat (Idaho) raised from 10.0 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.10	24.10+	24.10+
4	23.21	23.66	22.96
5	22.11	22.36	21.86
6	20.85	21.16	20.53
7	20.11	20.25	19.96
8	19.62	19.73	19.51
9	19.10	19.25	18.95
10	18.80	18.95	18.65
11	18.51	18.60	18.42
12	18.22	18.22	18.22
13	17.05	16.95	17.15
14	16.74	16.74	16.74
15	16.62	16.59	16.64

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 49. Kansas Hard Red Winter Wheat (Scoured) raised from 10.31 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	20.99	20.76	21.21
2	20.18	20.18	20.18
3	19.36	18.97	19.74
4	18.49	18.57	18.40
5	18.19	17.99	18.38
6	17.69	17.58	17.80
7	17.29	17.39	17.19
8	17.20	17.10	17.29
9	17.05	17.10	17.00
10	17.10	17.19	17.00
11	17.19	17.19	17.19
12	17.10	17.19	17.00
13	16.64	16.81	16.46
14	16.66	16.75	16.56
15	16.48	16.48	16.48

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 50. Kansas Hard Red Winter Wheat (Scoured) raised from 10.31 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	19.52	19.44	19.60
1	18.91	18.81	19.00
2	18.14	18.24	18.04
3	17.55	17.63	17.47
4	17.36	17.24	17.47
5	17.15	17.05	17.24
6	17.00	16.94	17.05
7	16.94	16.94	16.94
8	16.88	16.81	16.94
9	16.91	16.91	16.91
10	16.91	16.91	16.91
11	16.91	16.91	16.91
12	16.91	16.91	16.91
13	16.67	16.86	16.48
14	16.55	16.56	16.53
15	16.59	16.54	16.63

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

▨ 10.31 TO 16.00 TW- 61.32 AT 10.31% M.C.  
 ▩ 10.31 TO 12.50 TO 16.00 TW- 58.42 AT 12.5% M.C.

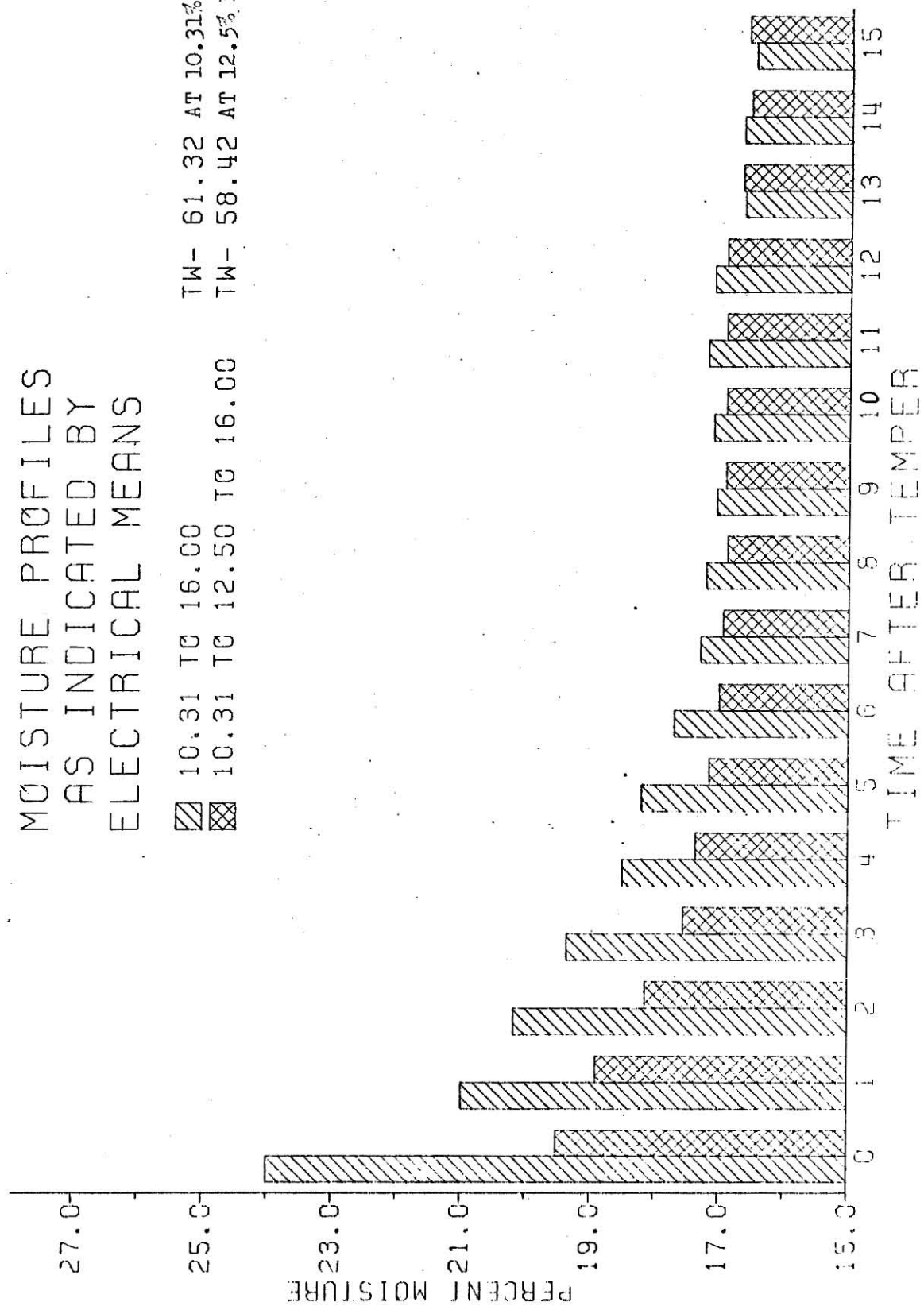


Figure 19. Kansas Hard Red Winter Wheat (Scoured) one temper versus two temper by Motomco.

Table 51. Kansas Hard Red Winter Wheat (Scoured) raised from 10.31 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	24.08	24.24	23.81
2	22.41	22.55	22.26
3	21.23	21.72	20.74
4	20.12	20.54	19.69
5	19.75	19.66	19.83
6	19.45	19.65	19.24
7	18.77	18.61	18.93
8	18.90	18.79	19.00
9	18.63	18.61	18.65
10	18.66	18.61	18.71
11	18.65	18.61	18.68
12	18.55	18.59	18.51
13	18.21	18.15	18.26
14	18.07	18.15	17.98
15	18.06	17.88	18.23

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 52. Kansas Hard Red Winter Wheat (Scoured) raised from 10.31 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	21.68	21.67	21.68
1	19.93	19.61	20.24
2	18.80	18.56	19.04
3	18.60	18.49	18.71
4	18.06	18.04	18.08
5	17.66	17.73	17.59
6	17.58	17.56	17.59
7	17.55	17.53	17.57
8	17.40	17.46	17.33
9	17.42	17.32	17.51
10	17.45	17.52	17.36
11	17.37	17.36	17.37
12	17.38	17.39	17.36
13	17.20	17.23	17.16
14	17.34	17.35	17.33
15	17.24	17.33	17.15

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

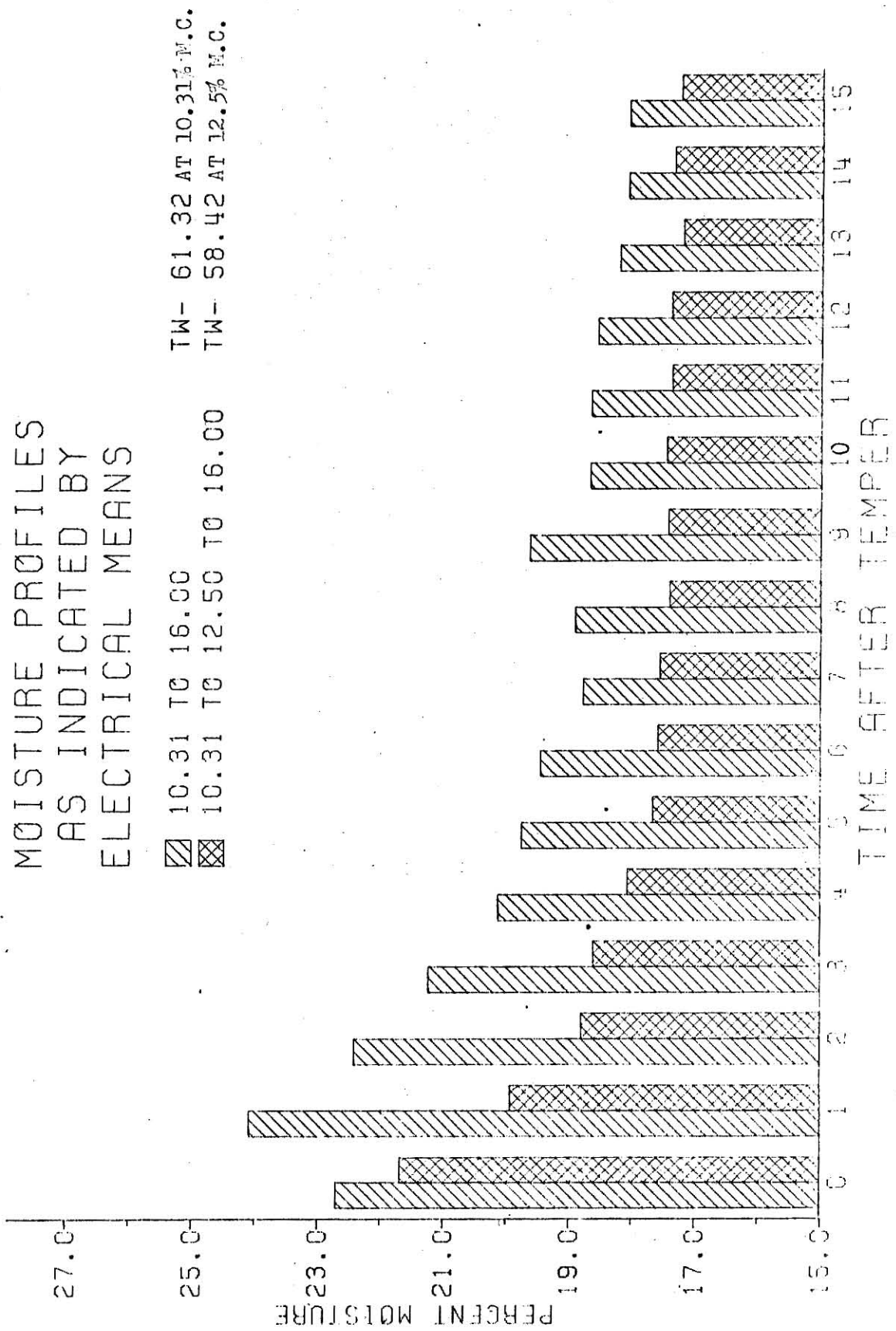


Figure 20. Kansas Hard Red Winter Wheat (Scoured) one temper versus two temper by Steinlite.

Table 53. Kansas Hard Red Winter Wheat (Scoured) raised from 10.31 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	24.21	24.46	23.96
4	22.67	22.96	22.38
5	21.51	21.73	21.28
6	20.48	20.69	20.26
7	19.80	19.92	19.68
8	19.33	19.40	19.25
9	18.85	18.95	18.75
10	18.58	18.75	18.40
11	18.10	18.10	18.10
12	17.92	17.92	17.92
13	16.95	16.95	16.95
14	16.40	16.38	16.41
15	16.03	16.03	16.03

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 54. Kansas Hard Red Winter Wheat (Scoured) raised from 10.31 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	23.14	22.99	23.29
2	22.28	22.44	22.11
3	21.10	21.01	21.19
4	20.35	20.21	20.48
5	19.81	19.87	19.74
6	19.07	19.13	19.01
7	18.58	18.58	18.58
8	18.12	18.10	18.13
9	17.83	17.83	17.83
10	17.55	17.55	17.55
11	17.46	17.46	17.46
12	17.26	17.25	17.27
13	16.51	16.51	16.51
14	16.17	16.23	16.10
15	15.95	15.91	15.98

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

TW- 61.32 AT 10.31% M.C.  
 TW- 58.42 AT 12.5% M.C.

10.31 TO 16.00  
 10.31 TO 12.50 TO 16.00

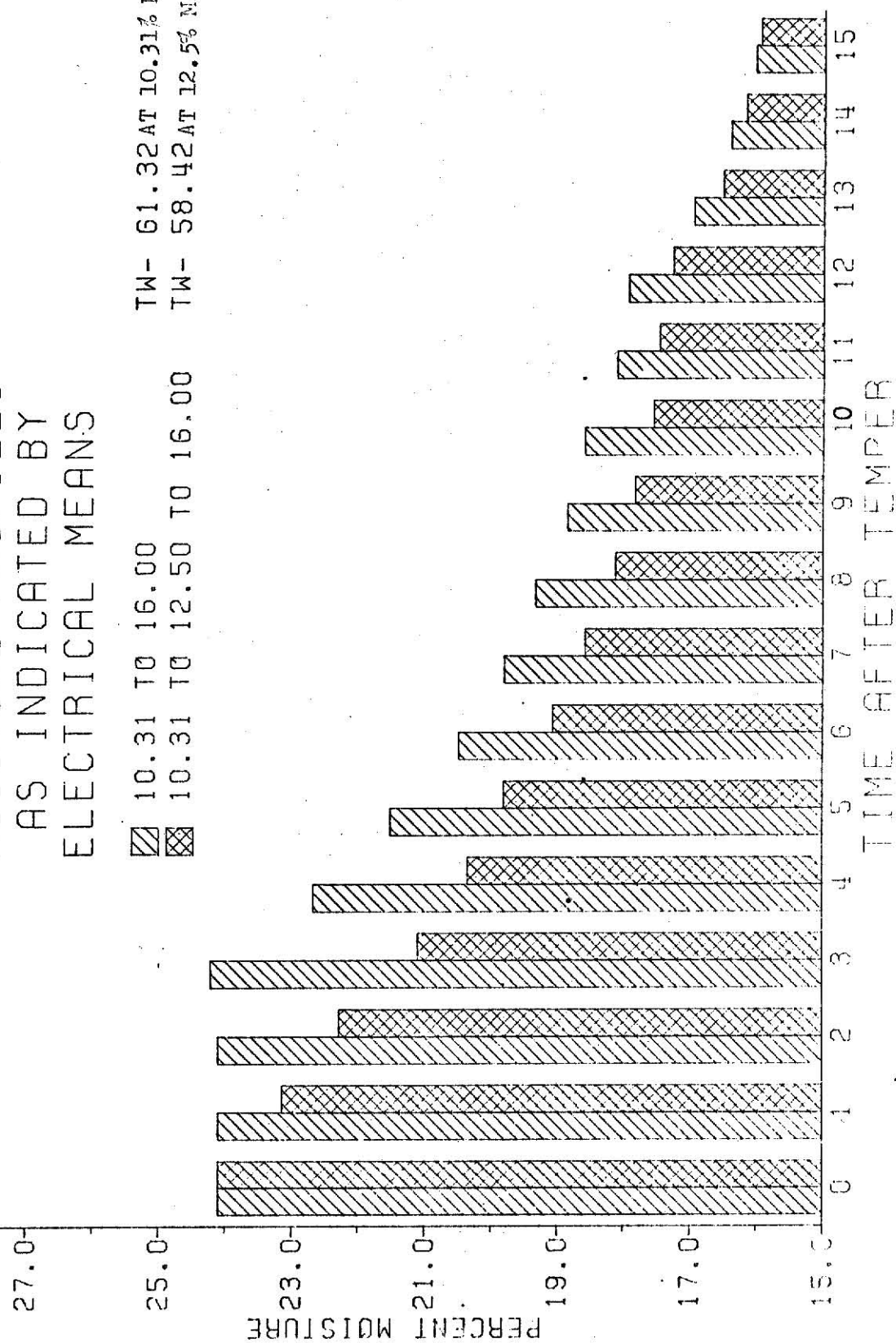


Figure 21. Kansas Hard Red Winter Wheat (Scoured) one temper versus two temper by Tag-Heppenstall.

Table 55. Soft Red Winter Wheat raised from 11.8 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	19.42	19.13	19.70
1	17.59	17.79	18.18
2	17.03	16.84	17.21
3	16.33	16.25	16.41
4	16.13	16.03	16.22
5	16.03	16.03	16.03
6	16.03	16.03	16.03
7	15.97	15.94	16.00
8	15.82	15.82	15.81
9	15.81	15.80	15.81
10	15.72	15.81	15.62
11	15.63	15.63	15.62
12	15.62	15.61	15.62

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 56. Soft Red Winter Wheat raised from 11.8 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	17.44	17.34	17.53
1	16.19	16.19	16.19
2	15.84	15.89	15.79.
3	15.59	15.59	15.58
4	15.57	15.58	15.55
5	15.46	15.36	15.55
6	15.56	15.56	15.55
7	15.51	15.46	15.55
8	15.44	15.43	15.44
9	15.25	15.34	15.15
10	15.16	15.16	15.15
11	15.15	15.14	15.15
12	15.14	15.15	15.13

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

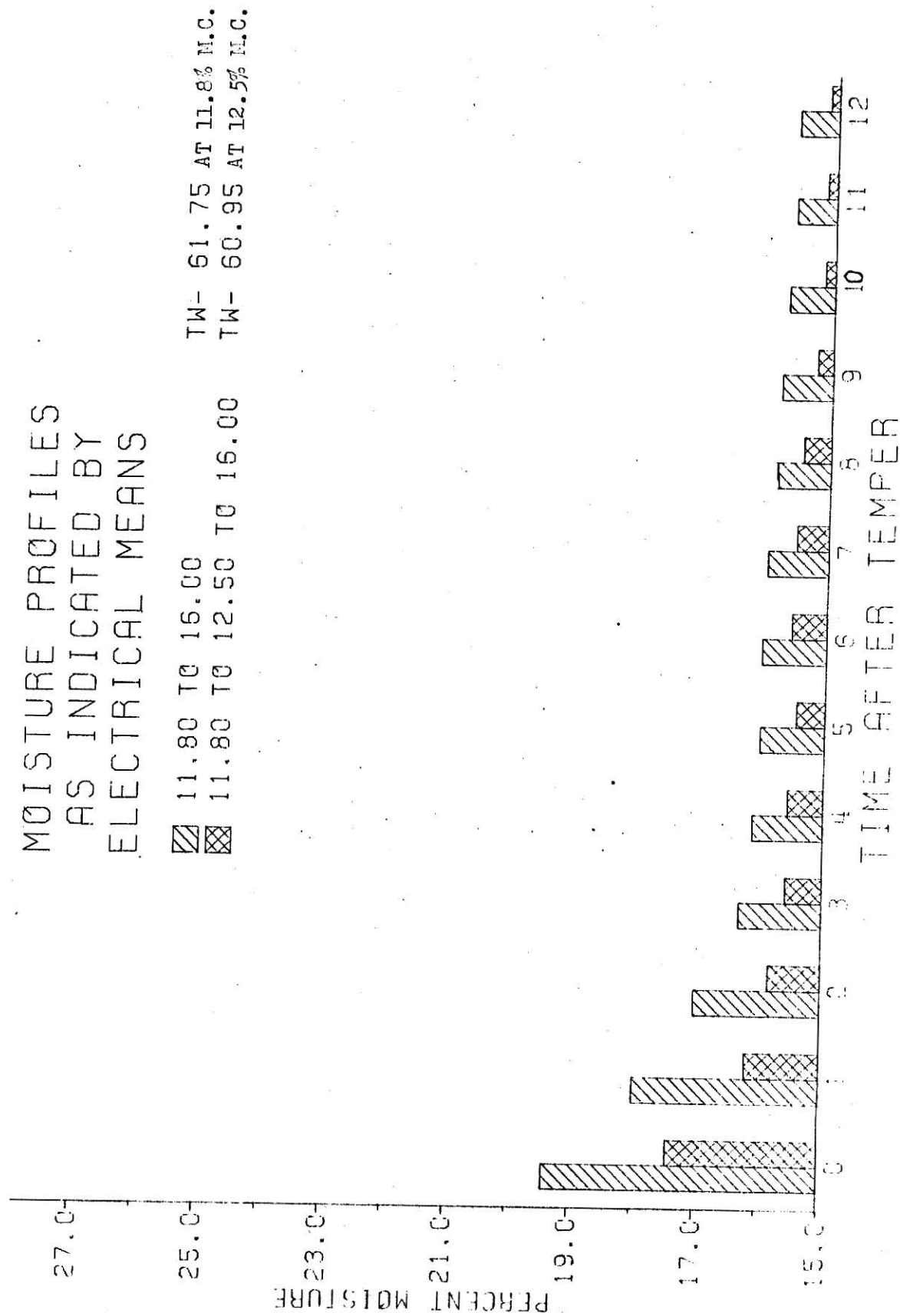


Figure 23. Soft Red Winter wheat one temper versus two temper by Notonco.

Table 57. Soft Red Winter Wheat raised from 11.8 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.39	23.00
1	20.77	20.33	21.20
2	18.95	18.57	19.33
3	18.30	18.25	18.35
4	17.83	17.66	17.99
5	17.66	17.72	17.60
6	17.60	17.59	17.60
7	17.52	17.45	17.58
8	17.33	17.15	17.51
9	17.28	17.39	17.16
10	17.37	17.36	17.37
11	17.02	16.94	17.09
12	17.02	16.94	17.09

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 58. Soft Red Winter Wheat raised from 11.8 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	19.50	19.46	19.53
1	17.65	17.57	17.73
2	16.86	16.91	16.80
3	16.63	16.61	16.64
4	16.82	16.79	16.65
5	16.46	16.51	16.40
6	16.53	16.27	16.68
7	16.38	16.28	16.47
8	16.36	16.20	16.52
9	16.33	16.20	16.45
10	16.26	16.20	16.31
11	16.22	16.12	16.31
12	16.15	16.01	16.28

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

TW- 61.75 AT 11.8% M.C.  
 TW- 60.95 AT 12.5% M.C.

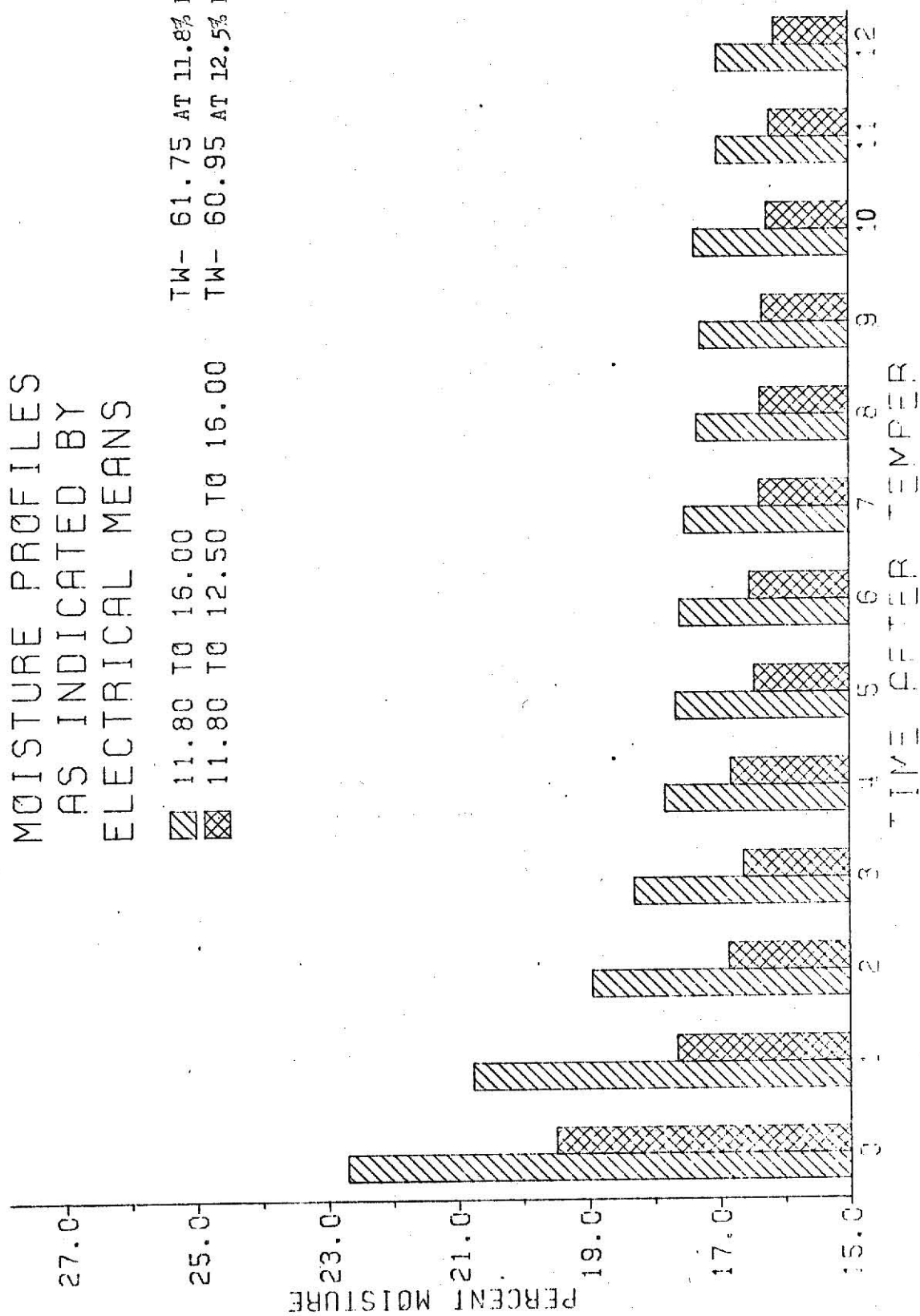


Figure 23. Soft Red Winter Wheat one temper versus two temper by Steinlite.

Table 59. Soft Red Winter Wheat raised from 11.8 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	22.90	22.90+	22.90+
1	22.90	22.90+	22.90+
2	22.64	22.35	22.93
3	21.00	20.67	21.32
4	19.59	19.50	19.68
5	18.65	18.50	18.80
6	18.07	18.07	18.07
7	17.62	17.58	17.66
8	17.26	17.19	17.32
9	17.05	17.05	17.05
10	16.84	16.75	16.93
11	16.75	16.75	16.75
12	16.63	16.50	16.75

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 60. Soft Red Winter Wheat raised from 11.8 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	22.90	22.90+	22.90+
1	22.26	22.18	22.33
2	20.17	20.17	20.17
3	18.62	18.62	18.62
4	17.75	17.69	17.80
5	17.18	17.18	17.18
6	16.71	16.70	16.72
7	16.58	16.51	16.64
8	16.34	16.34	16.34
9	16.17	16.17	16.17
10	16.08	15.99	16.17
11	15.94	15.88	15.99
12	15.79	15.74	15.84

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

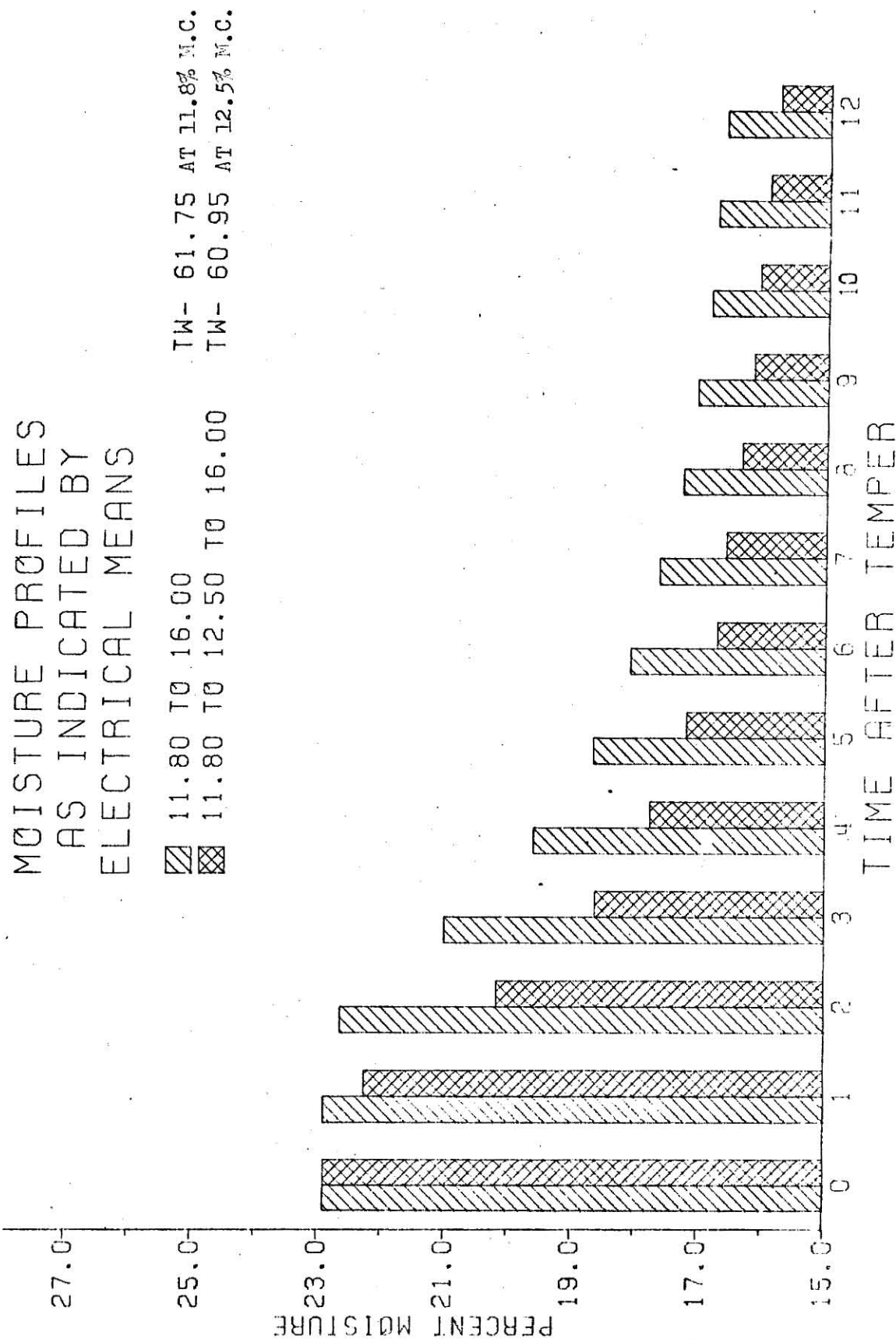


Figure 24. Soft Red Winter Wheat at one temper versus two temper by Tan-Hoppenstall.

Table 61. Durum Wheat raised from 10.1 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	22.55	22.55+	22.55+
1	21.41	21.49	21.32
2	19.87	20.07	19.67
3	18.98	19.32	18.63
4	18.37	18.63	18.11
5	17.19	17.34	17.04
6	16.77	16.50	17.04
7	16.94	17.02	16.85
8	16.58	16.50	16.65
9	16.48	16.48	16.48
10	16.39	16.30	16.48
11	16.30	16.30	16.30
12	16.30	16.30	16.30

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 62. Durum Wheat raised from 10.9 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	19.48	19.74	19.22
1	18.36	18.26	18.36
2	17.31	17.31	17.31
3	16.76	16.76	16.76
4	16.20	16.32	16.07
5	16.16	16.24	16.07
6	16.10	16.24	15.96
7	15.97	16.07	15.87
8	15.97	16.07	15.87
9	15.87	15.86	15.87
10	15.85	15.84	15.85
11	15.84	15.83	15.85
12	15.84	15.84	15.83

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

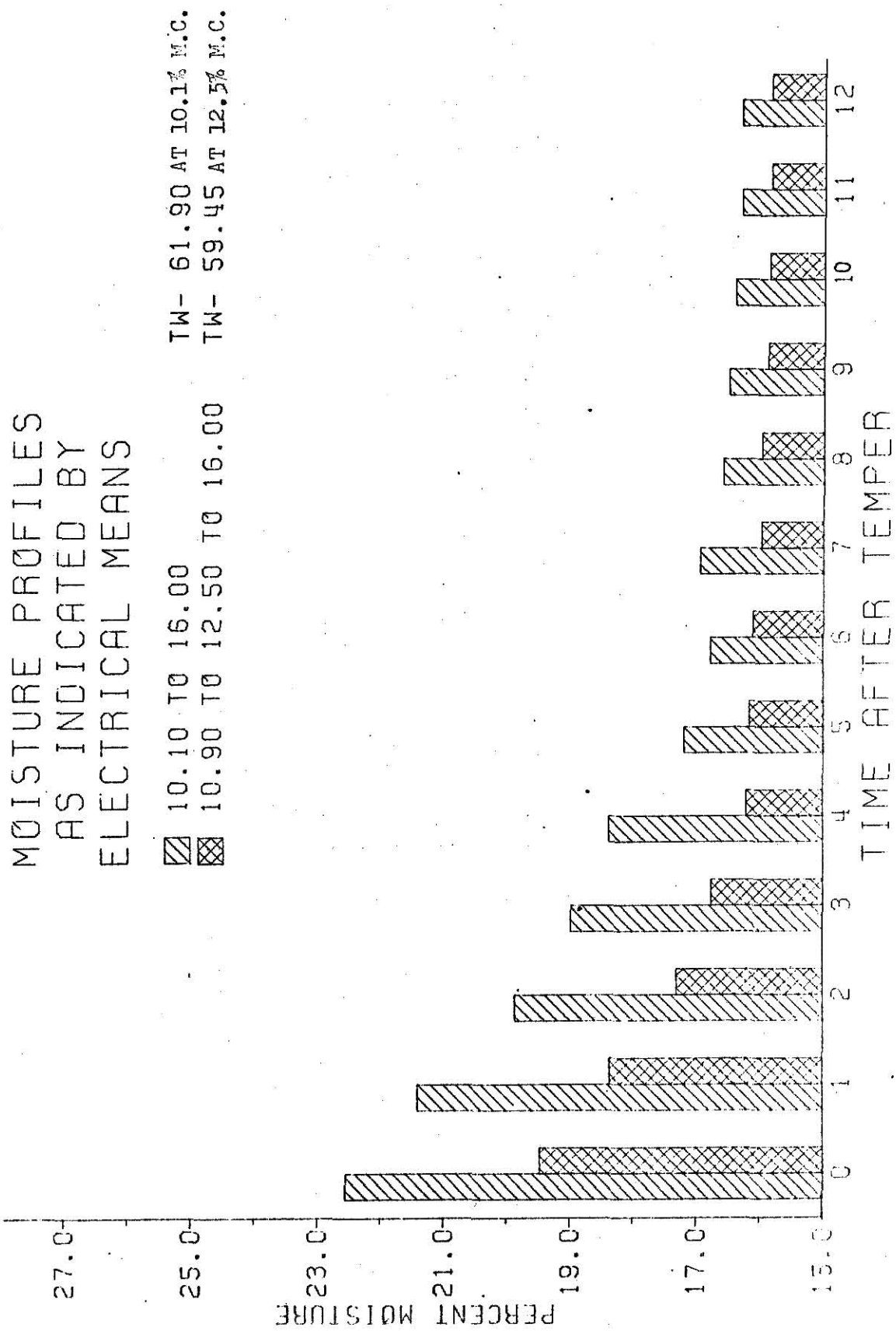


Figure 25. Durum Wheat one temper versus two temper by Hotomco.

Table 63. Durum Wheat raised from 10.1 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	23.82	23.82+	23.82+
1	23.82	23.82+	23.82+
2	23.70	23.79	23.61
3	22.43	23.00	21.85
4	21.02	21.39	20.64
5	19.80	20.13	19.47
6	18.88	19.02	18.73
7	18.85	18.98	18.72
8	18.80	18.82	18.77
9	18.61	18.66	18.56
10	18.65	18.59	18.70
11	18.51	18.52	18.49
12	18.47	18.59	18.35

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 64. Durum Wheat raised from 10.9 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	24.45	24.36	24.54
1	21.57	21.62	21.52
2	19.56	19.42	19.69
3	18.76	18.62	18.90
4	18.65	18.58	18.71
5	18.46	18.37	18.55
6	18.28	17.93	18.62
7	18.24	18.07	18.41
8	18.10	18.28	17.92
9	17.92	18.00	17.83
10	18.08	18.18	17.97
11	17.96	17.97	17.95
12	17.95	17.95	17.95

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

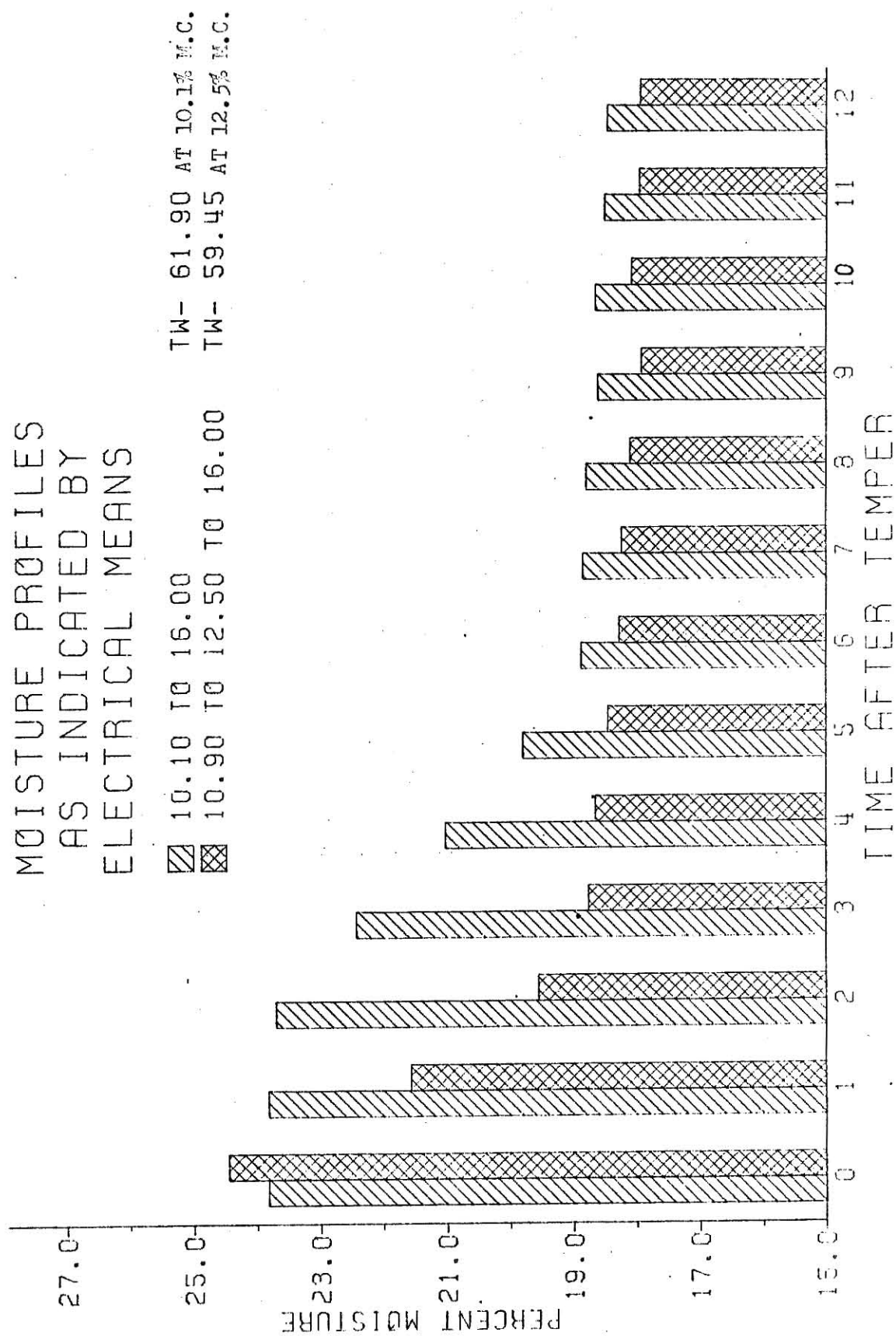


Figure 26. Durum wheat one temper versus two temper by Steinlite.

Table 65. Durum Wheat raised from 10.1 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	25.40	25.40+	25.40+
1	25.40	25.40+	25.40+
2	25.40	25.40+	25.40+
3	24.67	24.82	24.52
4	22.42	22.82	22.02
5	21.62	21.99	21.24
6	20.49	20.66	20.21
7	19.81	20.06	19.56
8	19.12	19.26	18.98
9	18.78	18.83	18.73
10	18.43	18.53	18.33
11	18.11	18.18	18.03
12	17.96	17.98	17.93

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 66. Durum Wheat raised from 10.9 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	25.40	25.40+	25.40+
1	25.46	25.49	25.43
2	22.81	23.08	22.53
3	20.78	20.95	20.60
4	19.65	19.70	19.60
5	18.95	18.90	19.00
6	18.39	18.48	18.30
7	18.09	18.18	18.00
8	17.64	17.68	17.60
9	17.48	17.48	17.48
10	17.13	17.00	17.25
11	16.99	17.00	16.98
12	16.93	16.93	16.93

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



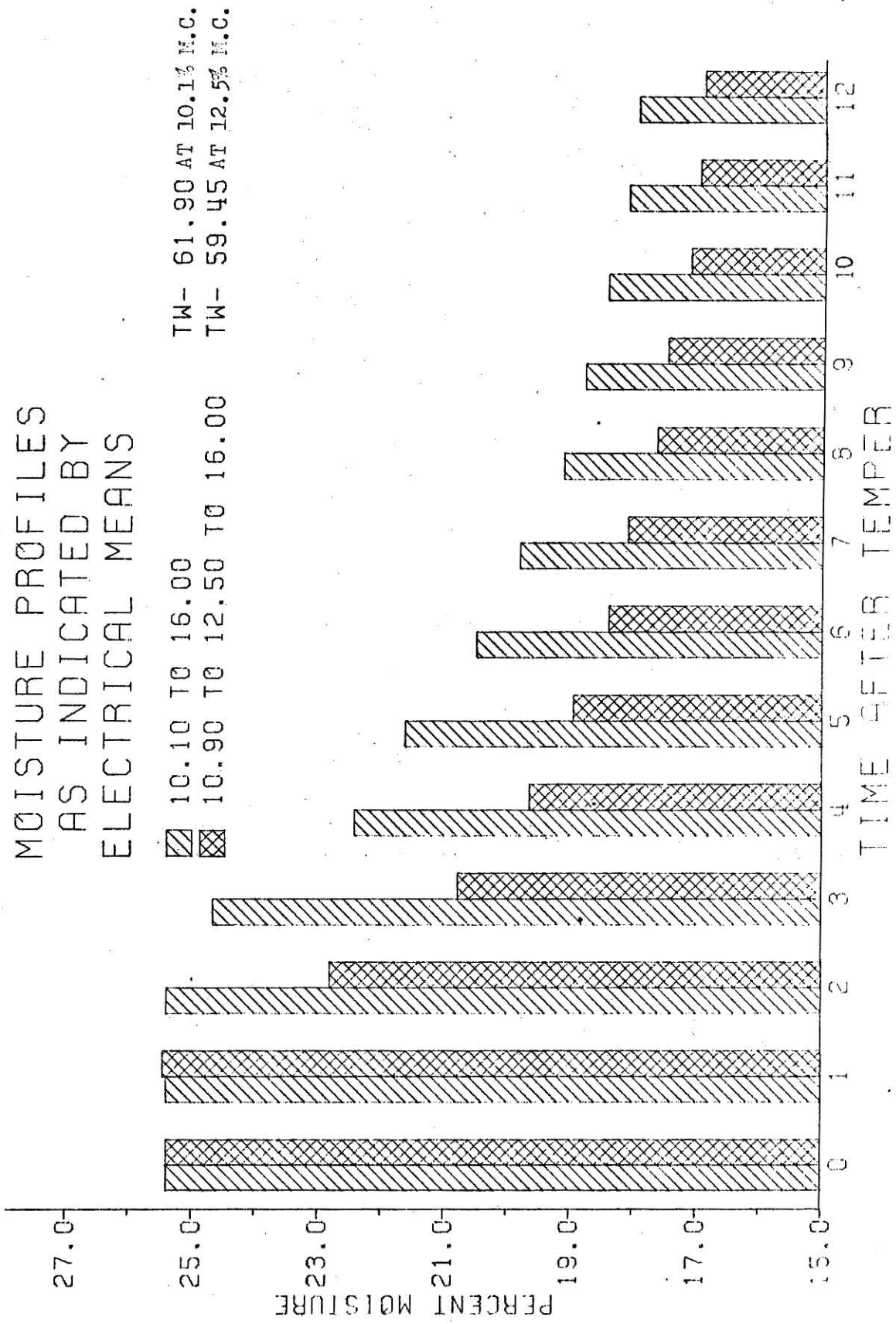


Figure 27. Durum Wheat one temper versus two temper by Tac-Herrenstall.

Table 67. Western White Wheat raised from 10.0 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.31	24.31+	24.31+
1	24.31	24.31+	24.31+
2	21.59	22.28	21.69
3	20.13	20.51	19.74
4	18.85	19.35	18.35
5	18.14	18.16	18.11
6	17.96	18.01	17.91
7	17.72	17.72	17.72
8	17.53	17.53	17.53
9	17.41	17.30	17.52
10	17.30	17.30	17.30
11	17.30	17.30	17.30
12	17.11	17.11	17.11
13	17.05	17.24	16.85
14	16.90	16.90	16.90
15	16.84	17.03	16.64

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 68. Western White Wheat raised from 10.0 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	20.54	20.44	20.63
1	19.07	19.08	19.06
2	18.27	18.48	18.06
3	17.49	17.68	17.29
4	17.09	17.09	17.09
5	16.88	16.90	16.85
6	16.85	16.85	16.85
7	16.75	16.66	16.83
8	16.64	16.64	16.64
9	16.63	16.64	16.61
10	16.56	16.51	16.61
11	16.56	16.51	16.61
12	16.56	16.51	16.61
13	16.37	16.27	16.47
14	16.32	16.32	16.32
15	16.45	16.45	16.45

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

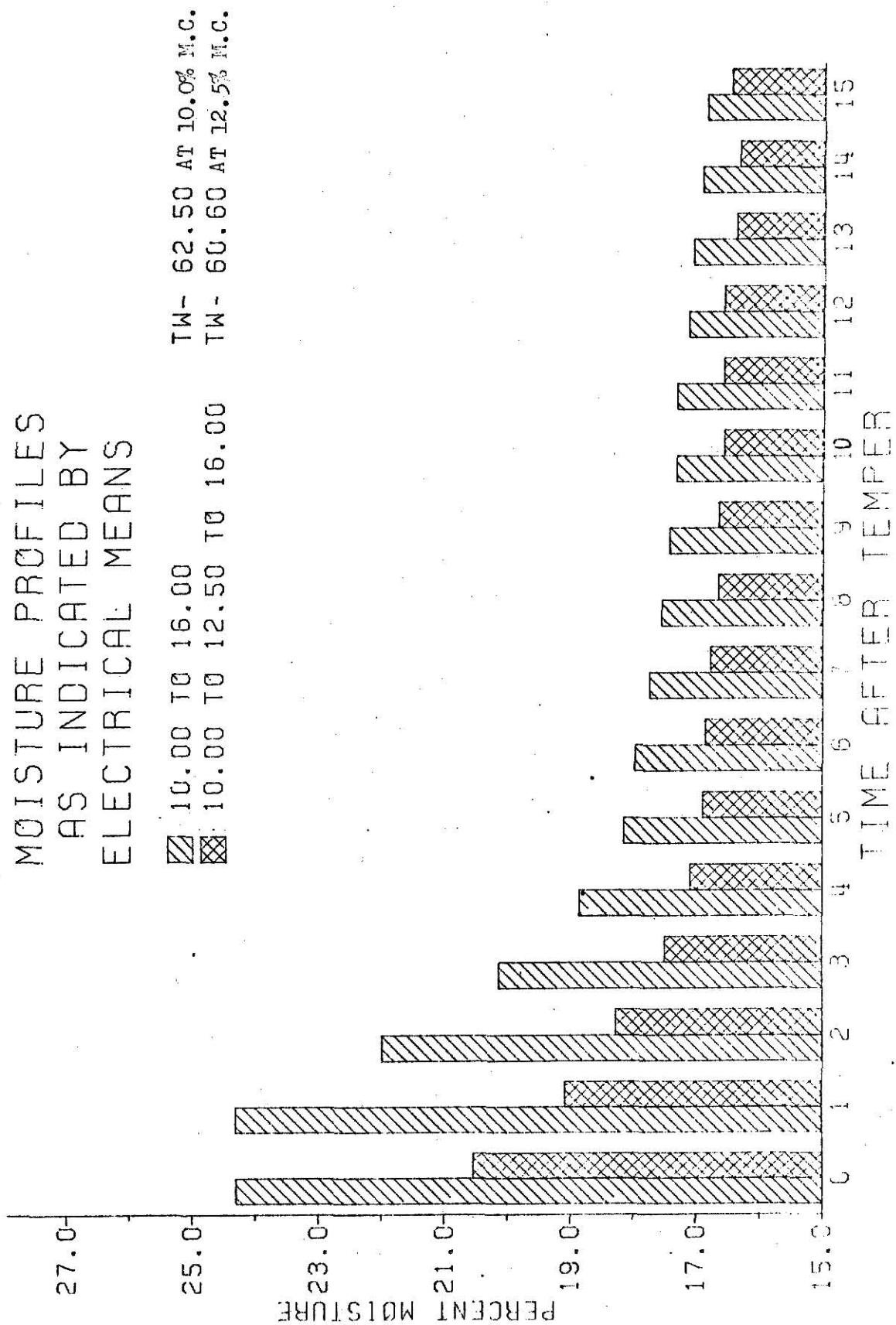


Figure 28. Western White Wheat one temper versus two temper by Motozoco.

Table 69. Western White Wheat raised from 10.0 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.10	22.10+	22.10+
1	22.10	22.10+	22.10+
2	23.02	23.08	22.96
3	21.52	21.96	21.08
4	20.06	20.32	19.79
5	19.30	19.43	19.16
6	19.11	19.14	19.08
7	18.88	18.90	18.86
8	18.79	18.70	18.88
9	18.58	18.50	18.65
10	18.52	18.50	18.53
11	18.44	18.35	18.53
12	18.42	18.35	18.48
13	18.22	18.38	18.05
14	17.83	18.05	17.61
15	17.96	18.18	17.74

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 70. Western White Wheat raised from 10.0 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.67	22.59	22.75
1	20.67	20.95	20.38
2	19.23	19.49	18.97
3	18.66	18.78	18.53
4	18.35	18.42	18.28
5	18.29	18.34	18.23
6	18.04	18.04	18.03
7	18.08	18.09	18.06
8	17.85	17.85	17.84
9	17.83	17.85	17.81
10	17.82	17.82	17.81
11	17.82	17.82	17.81
12	17.65	17.82	17.47
13	17.47	17.53	17.40
14	17.33	17.33	17.32
15	17.50	17.37	17.62

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

TW- 62.50 AT 10.0% M.C.  
 TW- 60.60 AT 12.5% M.C.

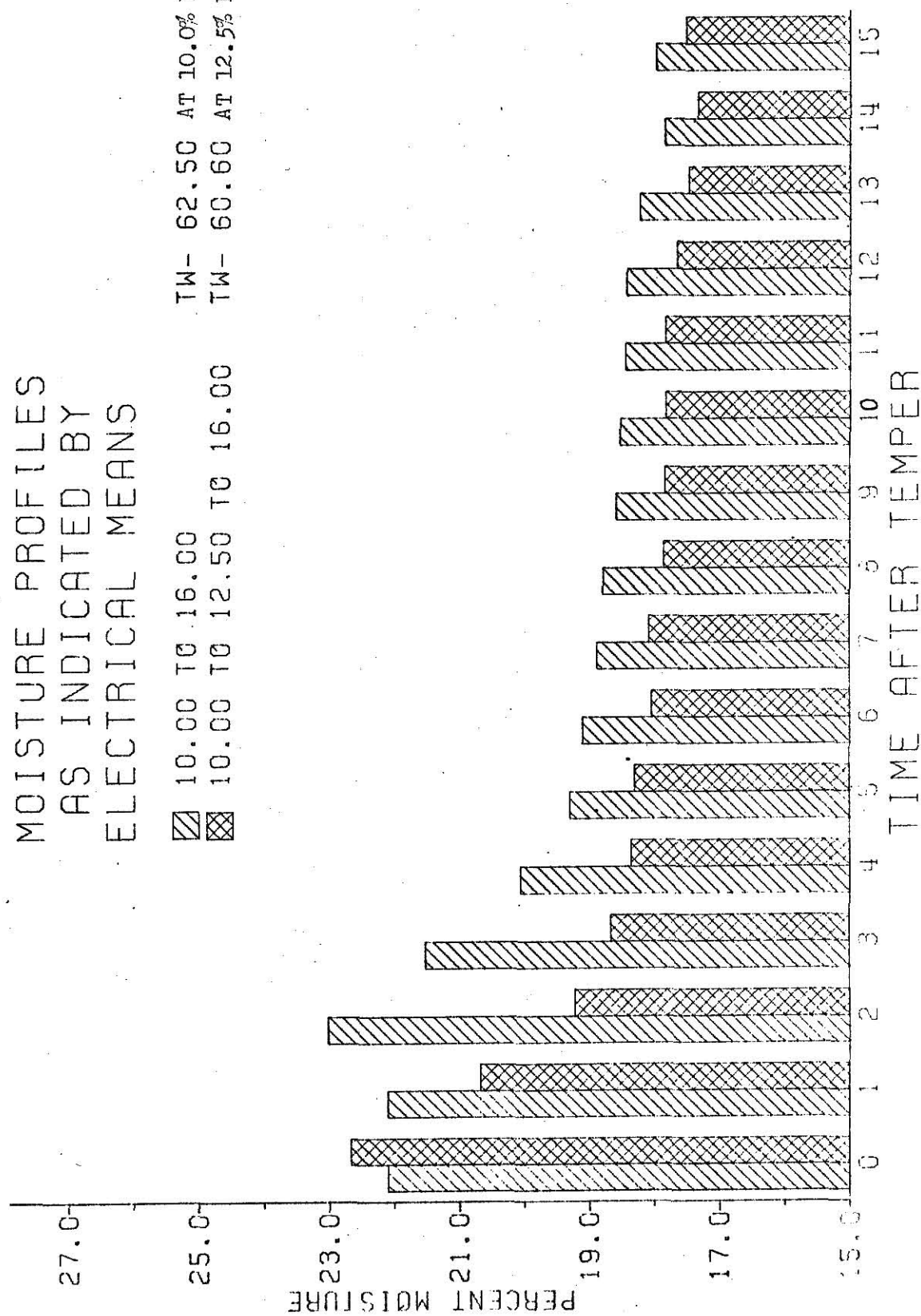


Figure 29. Western White Wheat one temper versus two temper by Steinlite.

Table 71. Western White Wheat raised from 10.0 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.30	24.30+	24.30+
1	24.30	24.30+	24.30+
2	24.30	24.30+	24.30+
3	23.75	23.87	23.62
4	22.24	22.27	22.21
5	20.83	21.01	20.64
6	19.83	19.83	19.83
7	19.27	19.35	19.19
8	18.78	18.83	18.72
9	18.30	18.33	18.27
10	17.54	17.57	17.90
11	17.77	17.69	17.84
12	17.64	17.62	17.65
13	16.82	16.82	16.82
14	16.46	16.51	16.40
15	16.36	16.40	16.31

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 72. Western White Wheat raised from 10.0 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.30	24.30+	24.30+
1	24.30	24.30+	24.30+
2	22.40	22.56	21.83
3	20.53	20.82	20.23
4	19.53	19.77	19.28
5	18.66	18.66	18.66
6	18.24	18.36	18.12
7	17.83	17.84	17.81
8	17.42	17.51	17.32
9	17.31	17.32	17.29
10	17.10	17.16	17.03
11	16.96	17.03	16.89
12	16.86	16.89	16.82
13	16.22	16.22	16.22
14	15.99	15.99	15.98
15	15.93	15.93	15.92

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

TW- 62.50 AT 10.0% H.C.  
 TW- 60.60 AT 12.5% H.C.

10.00 TO 16.00  
 10.00 TO 12.50 TO 16.00

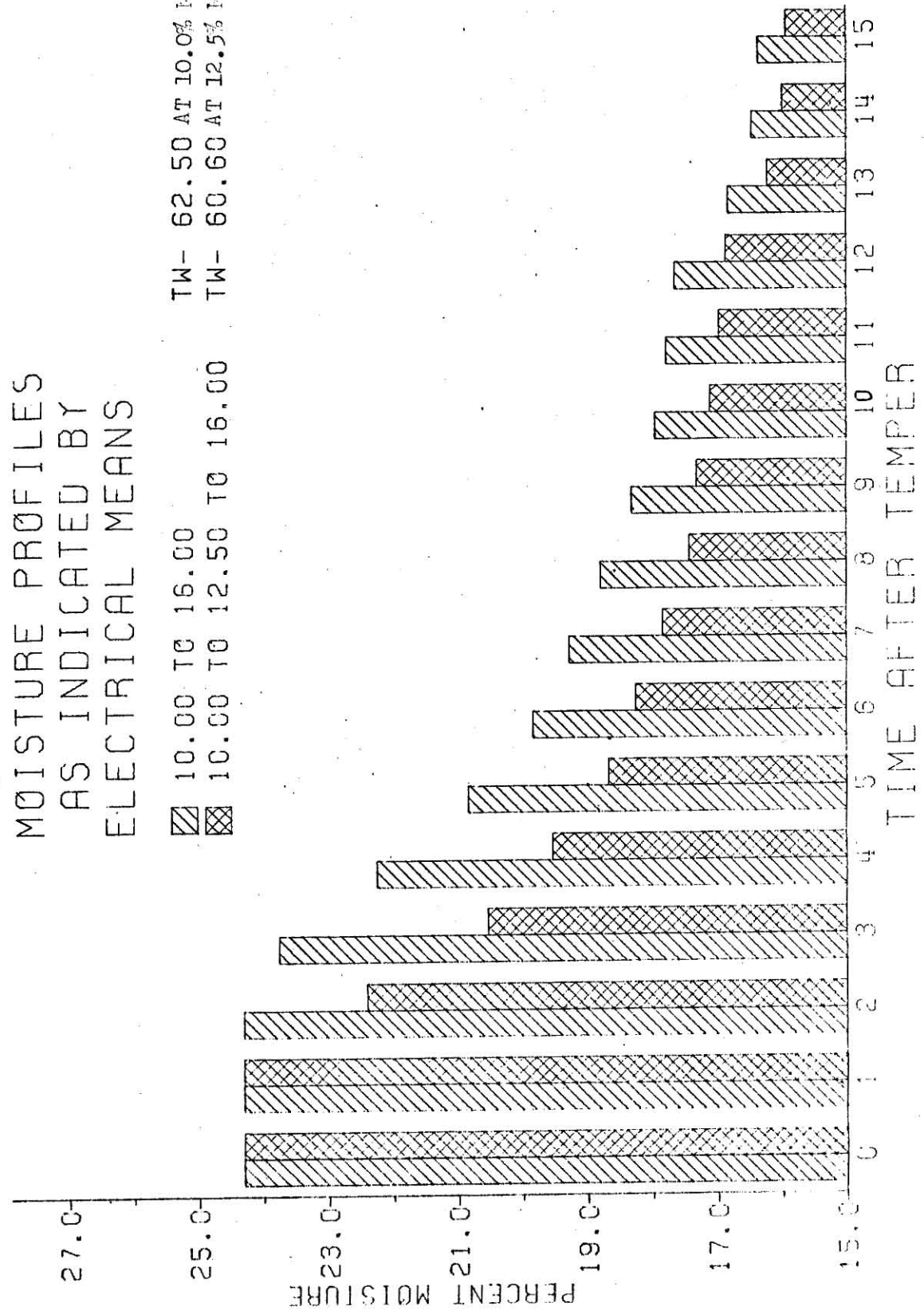


Figure 30. Western White Wheat one temper versus two temper by Tag-Heppenstall.

Hard Red Spring Wheat. Results in testing the Hard Red Spring Wheat are presented in Tables 73, 74 and 75. Tests were only made for one temper because an insufficient amount of the material was received. The rate of water penetration was equal to Hard Red Winter Wheat (See Tables 31, 33 and 35).

Red Grain Sorghum. Results in testing the Red Grain Sorghum are presented in Tables 76 through 84. The one temper versus the two temper are shown in Figures 31, 32 and 33. The one temper graphically shows a greater rate of water penetration over the two temper. Tests showed that the water would not move into the endosperm area with the second phase of tempering by the two temper system. The indicated moisture content for each of the three moisture meters was one to three per cent above the desired 16.0% moisture content with the two temper system.

Tables 82, 83 and 84 show test results when tempered to 17.0% moisture. The rates of water penetrations are equal to the rates of water penetration when tempered to 16.0% moisture.

Yellow Corn. Results in testing the Yellow Corn are presented in Tables 85 through 88. The one temper versus the two temper are shown in Figures 34 and 35. The two temper graphically showed an increased rate of water penetration over the one temper.

Brekke (11) discovered that adding moisture in increments when tempering corn had two effects. With less moisture added in any one step, less stress was created within the kernel and fewer kernels developed stress cracks. And secondly, because corn swells when it absorbs moisture, corn at 15.5% moisture level is less dense and thus possibly absorbs water more rapidly than corn at lower moisture levels.



Table 73. Hard Red Spring Wheat (Montana) raised from 11.25 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.56	24.56+	24.56+
1	22.40	22.40	22.40
2	20.61	20.61	20.61
3	19.39	19.39	19.39
4	18.99	18.99	18.99
5	18.04	17.80	18.27
6	17.86	17.58	18.14
7	17.65	17.75	17.55
8	17.35	17.35	17.35
9	17.15	16.95	17.35
10	17.04	16.95	17.13
11	17.03	16.93	17.13
12	16.93	16.93	16.93
13	16.85	16.75	16.95
14	16.60	16.60	16.60
15	16.48	16.58	16.38

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 74. Hard Red Spring Wheat (Montana) raised from 11.25 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	23.10	23.10+	23.10+
1	23.30	23.15	23.44
2	21.67	21.53	21.80
3	20.55	20.60	20.49
4	20.04	20.01	20.06
5	19.84	19.68	19.99
6	19.39	19.31	19.47
7	19.18	19.04	19.32
8	19.03	18.83	19.22
9	18.95	18.86	19.04
10	18.77	18.79	18.74
11	18.76	18.70	18.82
12	18.62	18.66	18.58
13	18.36	18.21	18.51
14	18.37	18.44	18.29
15	18.35	18.22	18.47

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 75. Hard Red Spring Wheat (Montana) raised from 11.25 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.30	24.30+	24.30+
1	24.30	24.30+	24.30+
2	24.30	24.30+	24.30+
3	22.93	23.23	22.63
4	21.61	21.43	21.78
5	20.79	20.82	20.76
6	20.03	20.04	20.01
7	19.52	19.52	19.52
8	18.99	19.07	18.90
9	18.54	18.54	18.54
10	18.13	18.14	18.11
11	17.98	17.99	17.97
12	17.80	17.62	17.97
13	16.95	16.95	16.95
14	16.81	16.84	16.78
15	16.30	16.30	16.30

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 76. Red Grain Sorghum raised from 10.68 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	22.44	22.44+	22.44+
1	19.44	19.50	19.38
2	19.05	19.04	19.05
3	18.41	18.40	18.41
4	17.98	17.72	18.23
5	18.05	18.04	18.05
6	17.70	17.53	17.57
7	17.44	17.53	17.34
8	17.20	17.06	17.34
9	17.06	17.06	17.06
10	17.06	17.06	17.06
11	17.06	17.06	17.06
12	16.93	16.97	16.88
13	16.84	16.93	16.75
14	16.49	16.49	16.49
15	16.48	16.38	16.58

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 77. Red Grain Sorghum raised from 10.45 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	19.24	19.24	19.24
1	18.78	18.78	18.78
2	18.35	18.10	18.60
3	18.07	18.10	18.03
4	17.93	17.91	17.95
5	17.58	17.57	17.59
6	17.57	17.57	17.56
7	17.62	17.57	17.66
8	17.54	17.49	17.59
9	17.54	17.49	17.59
10	17.48	17.38	17.57
11	17.47	17.38	17.55
12	17.47	17.38	17.55
13	17.37	17.36	17.39
14	17.02	17.02	17.02
15	17.01	17.02	16.99

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

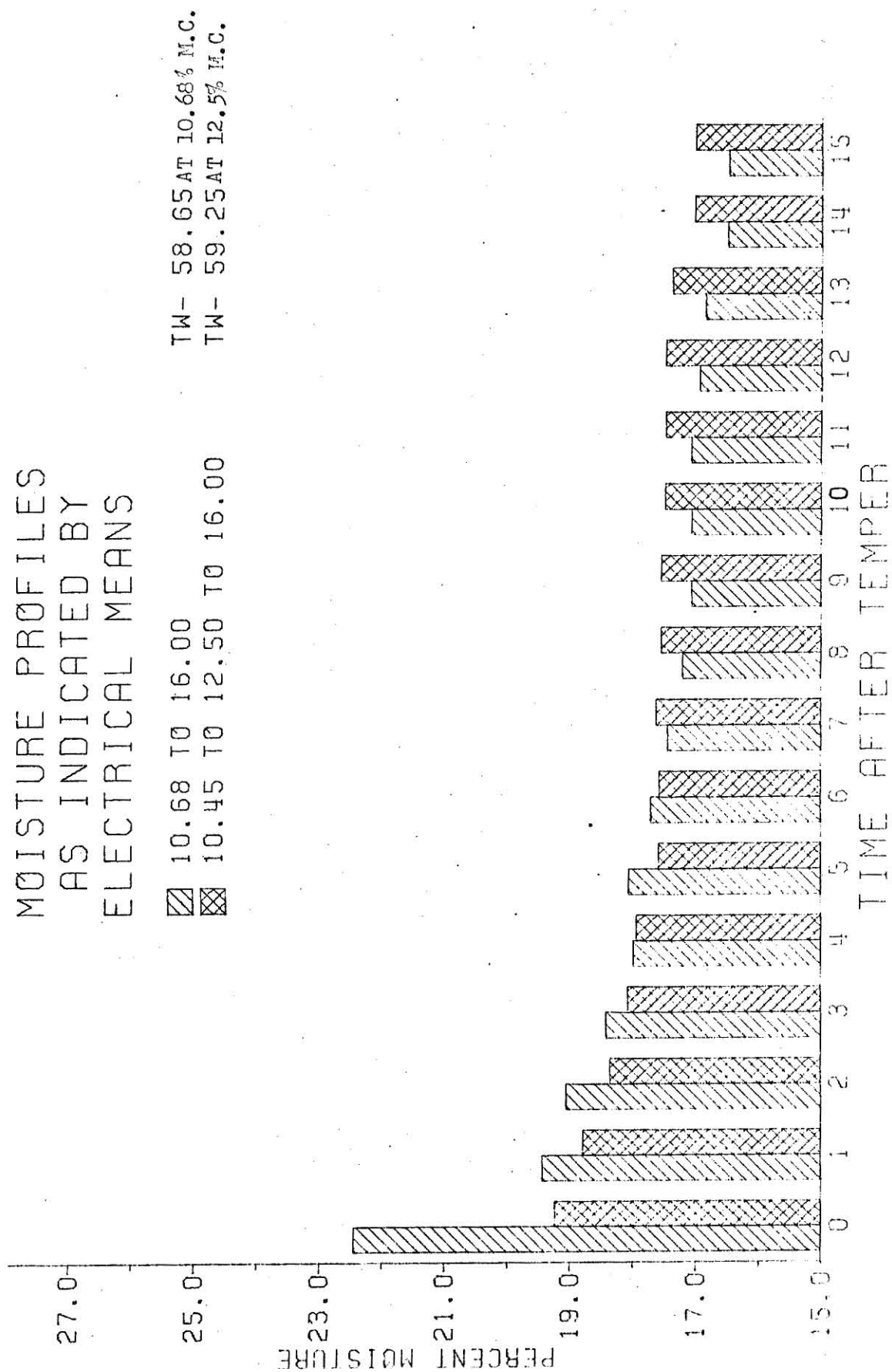


Figure 31. Red Grain Sorghum one temper versus two temper by Notonco.

Table 78. Red Grain Sorghum raised from 10.68 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.95	22.95+	22.95+
1	22.95	22.95+	22.95+
2	22.91	22.68	23.13
3	21.71	21.48	21.93
4	20.85	20.65	21.04
5	19.81	19.75	19.87
6	19.14	18.92	19.36
7	19.06	18.94	19.18
8	19.02	18.88	19.15
9	18.88	18.83	18.88
10	18.85	18.97	18.73
11	18.72	18.94	18.49
12	18.43	18.37	18.49
13	18.17	18.10	18.24
14	17.78	17.64	17.92
15	17.73	17.63	17.82

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 79. Red Grain Sorghum raised from 10.45 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.95	22.95+	22.95+
1	23.34	23.69	22.98
2	22.09	22.57	21.61
3	20.98	21.40	20.56
4	20.33	20.74	19.91
5	19.82	20.08	19.55
6	19.52	19.75	19.28
7	19.39	19.66	19.12
8	19.25	19.45	19.04
9	19.07	19.25	18.88
10	18.94	19.07	18.81
11	18.93	19.00	18.85
12	18.91	18.96	18.85
13	18.10	19.09	19.11
14	18.78	18.82	18.72
15	18.84	18.96	18.71

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

MOISTURE PROFILES  
AS INDICATED BY  
ELECTRICAL MEANS

▨ 10.68 TO 16.00

▩ 10.45 TO 12.50 TO 16.00

TW- 58.65 AT 10.68% H.C.

TW- 59.25 AT 12.5% H.C.

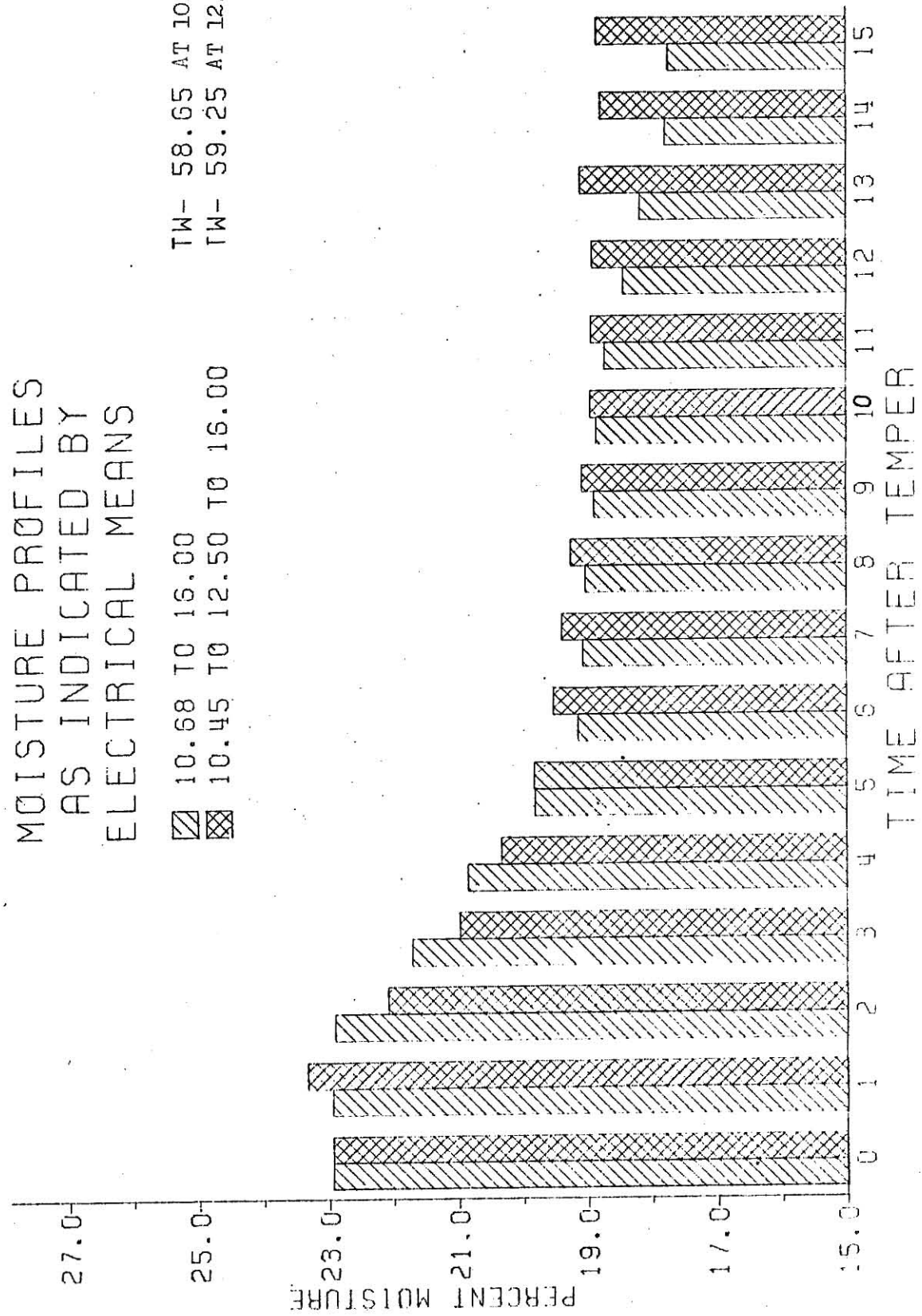


Figure 32. Red Grain Sorghum one temper versus two temper by Steinlite.

Table 80. Red Grain Sorghum raised from 10.68 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	21.30	21.30+	21.30+
1	21.30	21.30+	21.30+
2	21.30	21.30+	21.30+
3	21.52	21.55	21.48
4	21.23	21.28	21.38
5	20.47	20.20	20.63
6	19.88	19.60	19.85
7	19.47	19.43	19.50
8	19.07	18.93	19.20
9	18.61	18.68	18.53
10	18.53	18.68	18.38
11	18.21	18.23	18.18
12	17.56	17.58	17.93
13	17.03	17.03	17.03
14	16.53	16.53	16.53
15	16.25	16.25	16.25

AN ASTERISK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 81. Red Grain Sorghum raised from 10.45 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	21.30	21.30+	21.30+
1	21.30	21.30+	21.30+
2	21.48	21.40	21.55
3	20.84	20.65	21.03
4	20.28	20.03	20.53
5	19.84	19.63	20.05
6	19.34	19.23	19.45
7	19.07	18.83	19.30
8	18.84	18.73	18.95
9	18.67	18.53	18.80
10	18.37	18.20	18.53
11	18.23	18.10	18.35
12	18.13	18.05	18.20
13	17.45	17.35	17.55
14	17.12	17.00	17.25
15	16.97	16.93	17.00

AN ASTERISK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

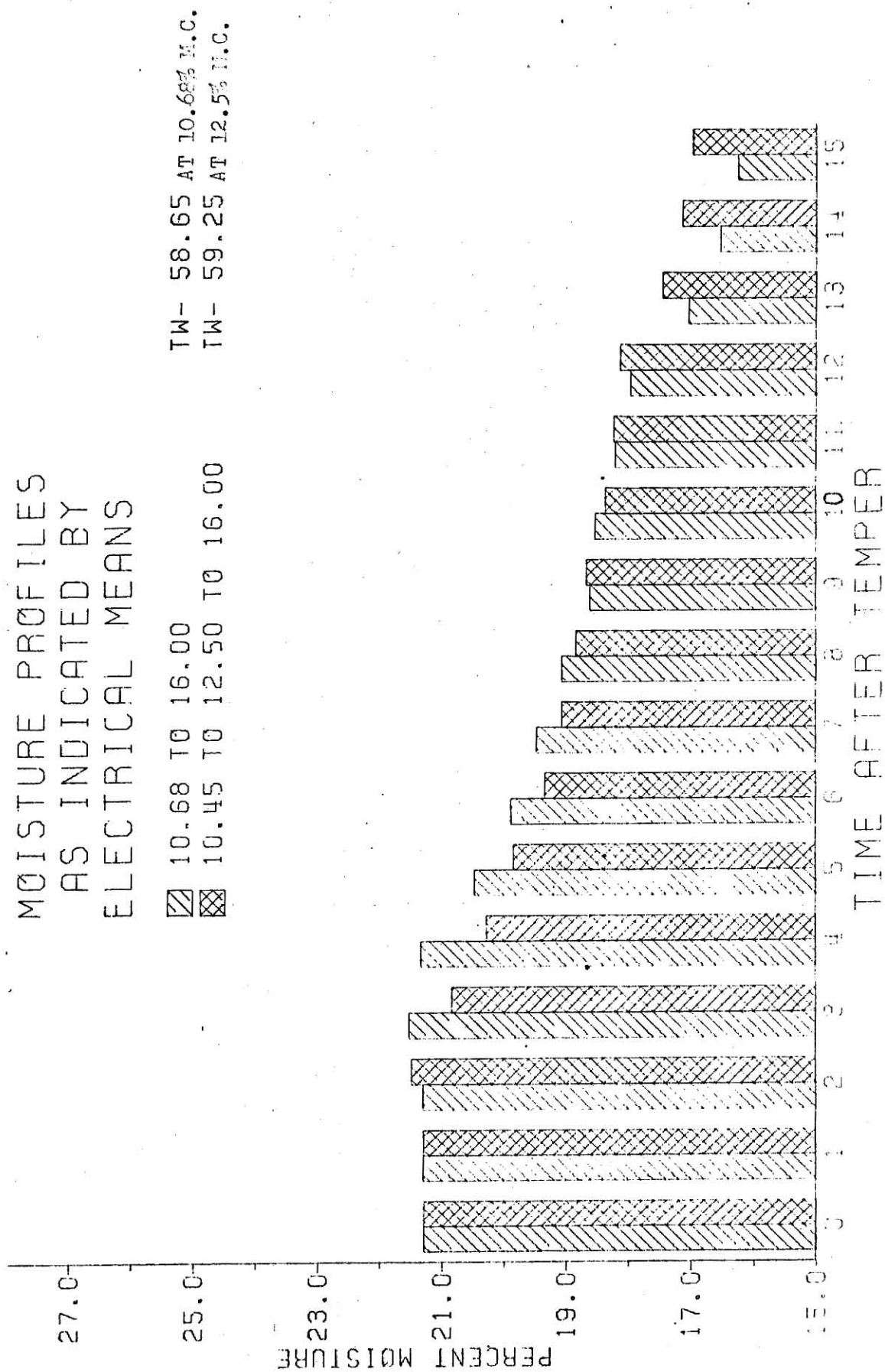


Figure 33. Red Grain Sorghum one temper versus two temper by Tag-Heppenstall.



Table 82. Red Grain Sorghum raised from 13.7 to 17.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	18.79	18.87	18.71
1	18.63	18.71	18.55
2	18.22	18.23	18.21
3	17.96	17.70	18.21
4	17.87	17.70	18.04
5	17.79	17.70	17.87
6	17.69	17.70	17.68
7	17.68	17.68	17.68
8	17.68	17.68	17.68
9	17.60	17.68	17.51
10	17.60	17.68	17.51
11	17.60	17.68	17.51
12	17.60	17.68	17.51
13	17.32	17.32	17.32
14	17.34	17.34	17.34

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 83. Red Grain Sorghum raised from 13.7 to 17.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.13	22.25	22.01
1	21.22	21.51	20.93
2	19.56	20.24	18.88
3	19.46	19.58	19.34
4	19.04	19.16	18.92
5	18.88	18.68	19.07
6	19.06	19.12	19.00
7	18.91	18.92	18.89
8	18.80	18.83	18.77
9	18.62	18.65	18.59
10	18.65	18.59	18.70
11	18.65	18.53	18.77
12	18.62	18.59	18.65
13	18.47	18.41	18.53
14	18.15	18.31	17.99

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 84. Red Grain Sorghum raised from 13.7 to 17.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	21.63	21.64	21.61
1	21.44	21.55	21.33
2	20.77	21.13	20.40
3	20.10	20.20	19.90
4	19.63	19.80	19.45
5	19.18	19.45	18.90
6	18.67	18.80	18.53
7	18.28	18.38	18.18
8	17.98	18.08	17.88
9	17.66	17.73	17.58
10	17.51	17.58	17.43
11	17.38	17.48	17.28
12	17.23	17.28	17.18
13	16.66	16.68	16.63
14	16.18	16.15	16.20

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 85. Yellow Corn raised from 12.8 to 21.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.87	24.87+	24.87+
1	24.87	24.87+	24.87+
2	22.76	22.76	22.76
3	22.36	22.37	22.35
4	22.46	22.37	22.55
5	22.35	22.37	22.33
6	22.34	22.35	22.33
7	21.95	21.96	21.94
8	21.95	21.96	21.94
9	21.95	21.96	21.94
10	21.83	21.94	21.71
11	21.73	21.74	21.71
12	21.53	21.35	21.71
13	21.43	21.35	21.51

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 86. Yellow Corn raised from 12.8 to 15.0 to 21.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2	TEST 3
0	22.65	22.23	22.69	22.94
1	22.44	21.91	22.69	22.72
2	22.11	22.10	22.10*	22.13
3	21.92	21.91	21.71	22.13
4	21.71	21.71	21.71	21.71
5	21.71	21.71	21.71	21.71
6	21.64	21.51	21.71	21.71
7	21.32	21.12	21.32	21.51
8	21.32	21.12	21.32	21.51
9	21.32	21.12	21.32	21.51
10	21.31	21.10	21.32	21.51
11	21.24	21.10	21.12	21.51
12	21.18	21.10	21.12	21.32
13	20.91	20.92	20.90	20.92

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

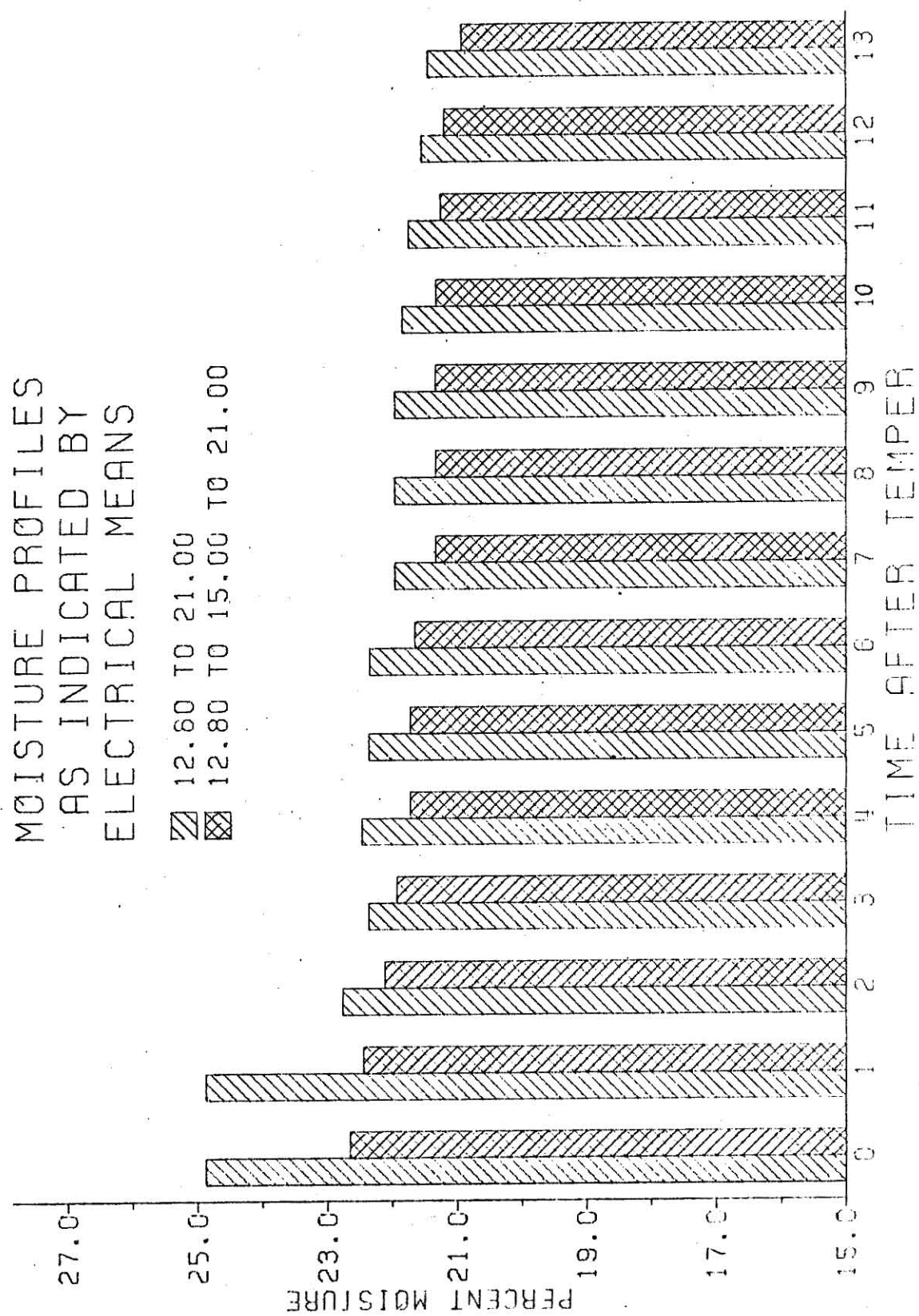


Figure 34. Yellow Corn one temper versus two temper by lotomco.

Table 87. Yellow Corn raised from 12.8 to 21.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	35.21	33.73	36.69
1	32.03	28.43	35.62
2	28.61	27.61	29.61
3	28.67	28.15	29.15
4	27.72	28.75	26.69
5	26.70	26.13	27.26
6	27.04	26.54	27.54
7	26.05	26.99	25.10
8	26.21	26.84	25.58
9	26.07	25.93	26.21
10	25.16	25.90	24.42
11	25.00	24.14	25.86
12	23.62	22.97	24.26
13	22.44	21.58	23.30

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 88. Yellow Corn raised from 12.8 to 15.0 to 21.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2	TEST 3
0	28.17	28.49	27.78	28.23
1	27.40	27.22	26.17	29.80
2	26.88	27.22	27.07	26.36
3	25.86	25.70	25.06	26.81
4	24.95	25.54	24.26	25.06
5	23.99	23.30	23.94	24.74
6	23.38	23.46	23.54	23.14
7	23.03	22.99	22.98	23.14
8	23.46	23.14	22.98	24.26
9	23.09	23.14	22.34	23.78
10	23.29	23.10	22.98	23.78
11	22.91	22.62	22.98	23.14
12	22.91	22.62	22.82	23.30
13	21.58	21.06	21.66	22.02

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

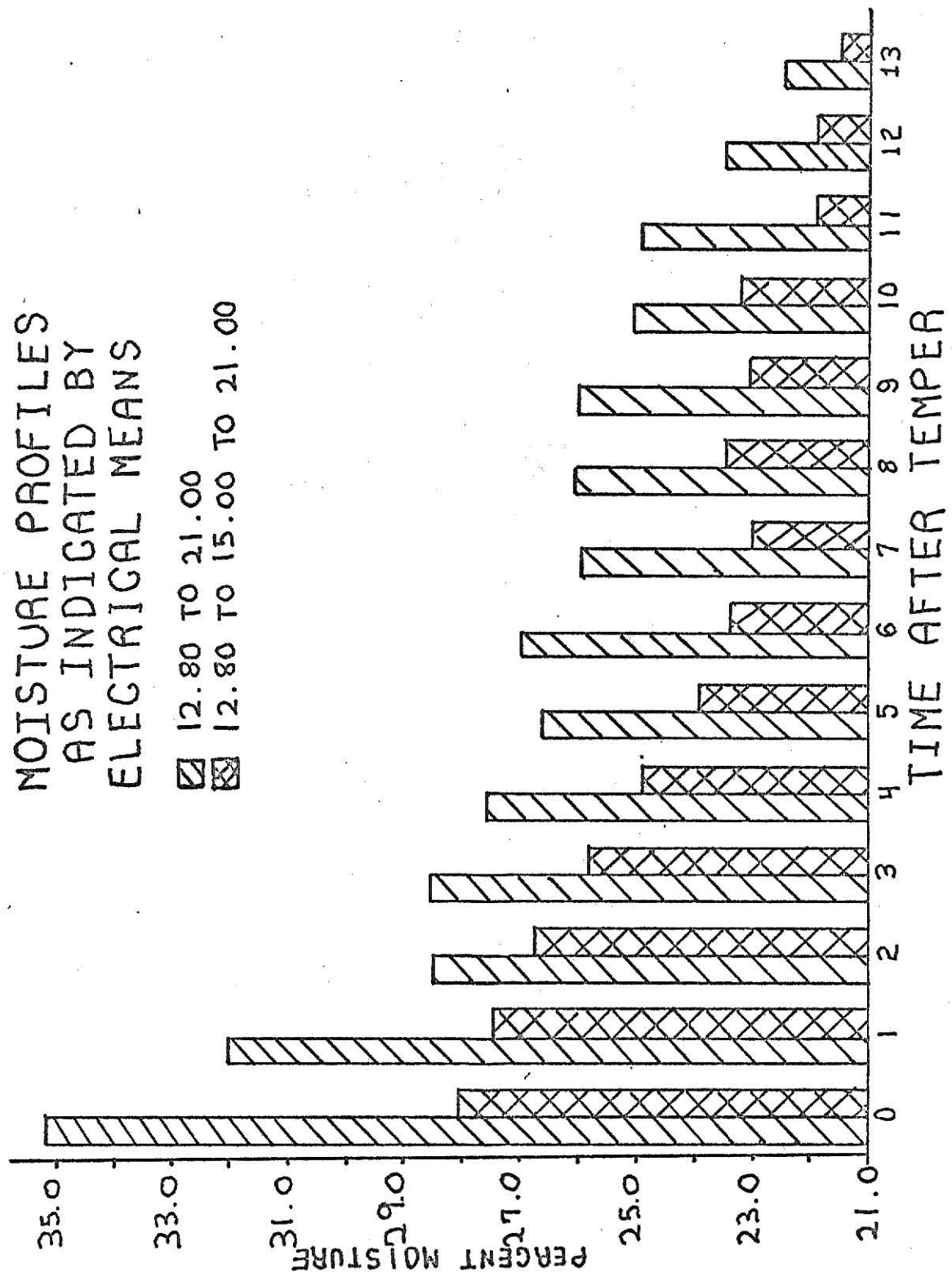


Figure 35. Yellow Corn one temper versus two temper by Steinlite.

Oats. Results in testing the Oats are presented in Tables 89 through 94. The one temper versus the two temper are shown in Figures 36, 37 and 38. The two temper had a greater rate of water penetration over the one temper.

Rye. Results in testing the Rye are presented in Tables 95 through 100. The one temper versus the two temper are shown in Figures 39, 40 and 41. The two temper had a greater rate of water penetration over the one temper.

Barley. Results in testing the Barley are presented in Tables 101 through 106. The one temper versus the two temper are shown in Figures 42, 43 and 44. The two temper had a significant increase in rate of water penetration over the one temper.

Several investigators through the history of milling have reported that variation in tempering from the normal cold water being added to room temperature grain would alter the tempering time required for proper milling. Jones and Campbell (37) found that temperature affected rate of moisture penetration. By raising the temperature 12°C between 20°C and 43.5°C, the rate of moisture penetration was increased threefold. This discovery led to three tempering variations being tested.

Heated Grain. Results from testing Heated Kansas Hard Red Winter Wheat (Sage) are presented in Tables 108, 110 and 112. The wheat was heated to a temperature of 110°F prior to adding temper water from the tap. Test were made with one temper and compared to normally tempered wheat (Tables 107, 109 and 111) graphically (Figures 45, 46 and 47). The rate of water penetration of the hot wheat treatment was only slightly greater than the normally tempered wheat for the Motomco. The Steinlite and Tag-Heppenstall had relatively the same rates of water penetration. Haltmeir (30) and Jones and Campbell (37) found that moisture equilibrium could be reached more quickly in the heated samples than in those kept at room temperature. These tests did not support their findings.

Table 89. Oats raised from 9.8 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	25.69	25.69+	25.69+
1	25.69	25.69+	25.69+
2	25.37	25.35	25.38
3	24.11	24.68	23.54
4	22.87	23.59	21.75
5	21.41	21.30	21.51
6	21.06	21.51	20.60
7	20.49	20.37	20.60
8	19.93	19.93	19.93
9	19.48	19.48	19.48
10	19.48	19.48	19.48
11	19.48	19.48	19.48
12	19.25	19.25	19.25
13	18.39	18.39	18.39
14	18.60	18.60	18.60
15	18.17	18.17	18.17

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 90. Oats raised from 9.8 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	23.95	23.83	24.06
1	22.71	23.16	22.26
2	21.61	22.26	21.36
3	20.57	20.91	20.23
4	20.00	19.77	20.23
5	19.55	19.55	19.55
6	19.32	19.55	19.08
7	19.07	19.08	19.06
8	18.84	19.06	18.62
9	18.73	18.83	18.62
10	18.62	18.61	18.62
11	18.38	18.38	18.38
12	18.16	18.16	18.16
13	17.85	17.74	17.96
14	18.41	18.41	18.41
15	18.19	18.19	18.19

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



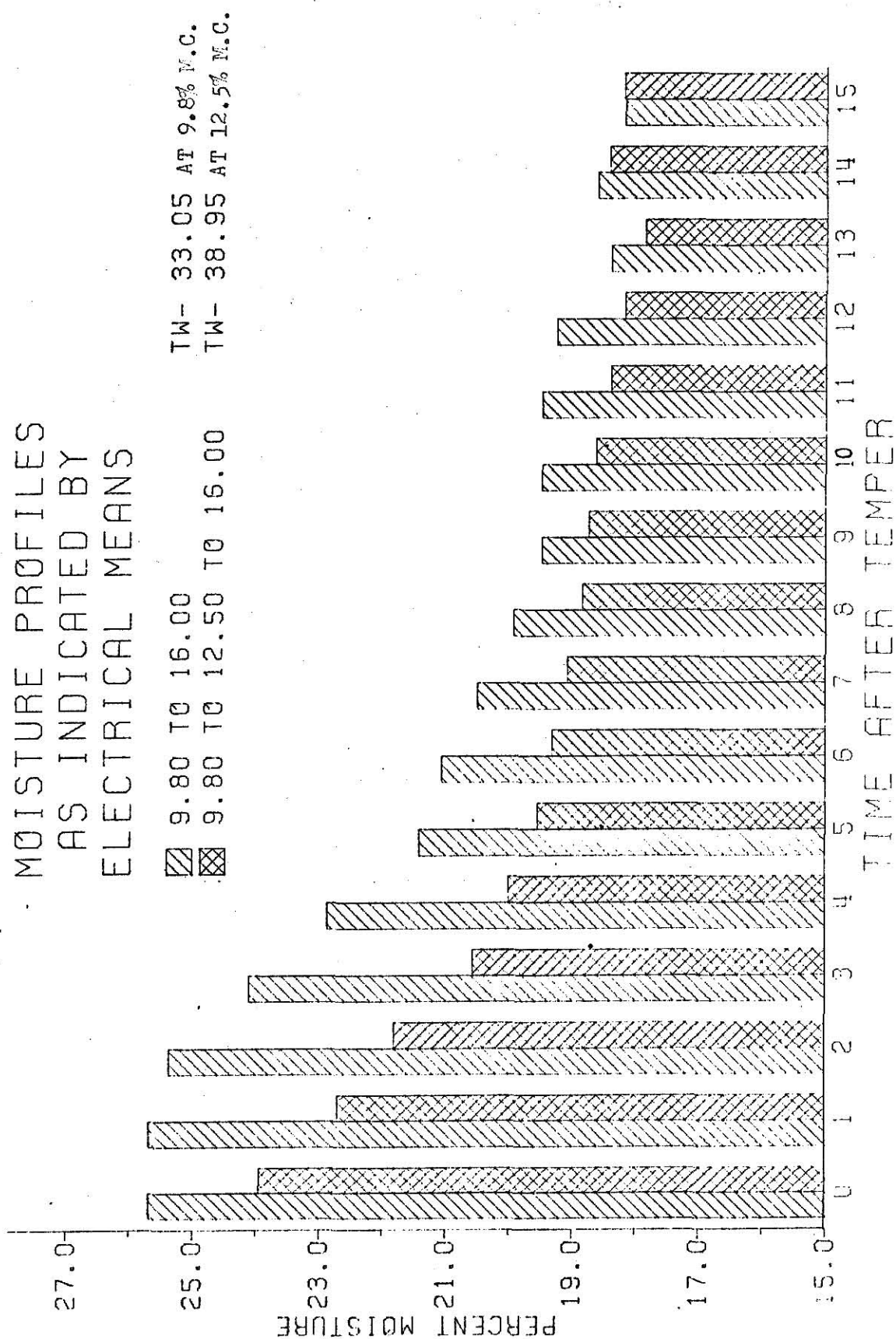


Figure 36. Oats one temper versus two temper by Motozoo.

Table 91. Oats raised from 9.8 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	21.66	21.66+	21.66+
1	21.79	21.79	21.78
2	21.05	20.97	21.13
3	20.60	20.55	20.65
4	20.59	20.52	20.65
5	20.46	20.52	20.39
6	20.01	20.11	19.91
7	19.68	19.59	19.76
8	19.65	19.59	19.70
9	19.44	19.39	19.49
10	19.41	19.36	19.46
11	19.20	19.21	19.19
12	19.20	19.21	19.19
13	18.89	18.90	18.87
14	18.30	18.66	18.54
15	17.76	17.76	17.75

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 92. Oats raised from 9.8 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	21.67	22.81	20.52
1	20.20	20.31	20.08
2	19.99	19.99	19.99
3	19.50	19.63	19.36
4	19.36	19.42	19.30
5	19.14	19.21	19.06
6	19.05	19.06	19.04
7	19.00	18.98	19.01
8	18.95	18.95	18.95
9	18.73	18.84	18.61
10	18.70	18.72	18.68
11	18.48	18.72	18.24
12	18.27	18.30	18.24
13	17.87	18.05	17.68
14	17.68	17.64	17.92
15	17.63	17.78	17.48

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

MOISTURE PROFILES  
AS INDICATED BY  
ELECTRICAL MEANS

TW- 33.05 AT 9.8% M.C.  
 TW- 38.95 AT 12.5% M.C.

9.80 TO 16.00  
 9.80 TO 12.50 TO 16.00

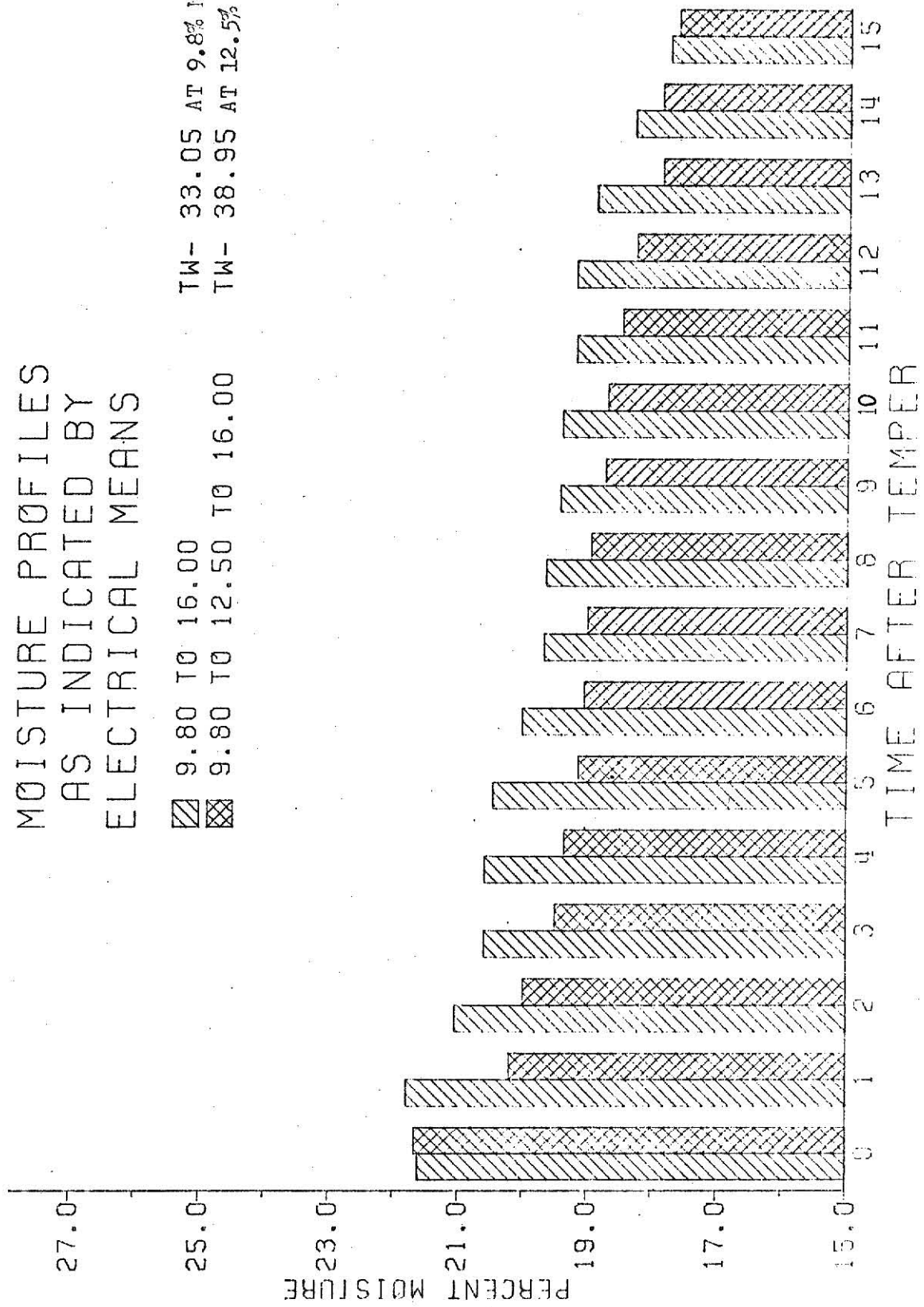


Figure 37. Cats one temper versus two temper by Steinlite.

Table 93. Oats raised from 9.8 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.11	22.26	22.95
1	21.44	21.81	21.07
2	20.70	20.64	20.75
3	20.18	20.40	19.95
4	19.65	19.65	19.65
5	18.92	18.94	18.90
6	17.82	17.75	17.98
7	17.81	17.73	17.98
8	17.81	17.73	17.88
9	17.81	17.73	17.88
10	17.74	17.73	17.75
11	17.74	17.73	17.75
12	17.42	17.30	17.53
13	16.74	16.74	16.74
14	16.33	16.17	16.48
15	15.77	15.77*	15.77*

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 5% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 94. Oats raised from 9.8 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	20.87	21.25	20.48
1	19.77	19.78	19.76
2	19.32	19.22	19.41
3	18.91	19.05	18.76
4	18.49	18.49	18.49
5	18.01	17.93	18.18
6	17.82	17.82	17.81
7	17.80	17.81	17.79
8	17.34	17.34	17.34
9	17.33	17.32	17.34
10	17.24	17.22	17.16
11	17.04	16.94	17.14
12	16.94	16.94	16.94
13	16.43	16.50	16.39
14	15.99	15.99	15.98
15	15.98	15.99	15.97

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 5% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

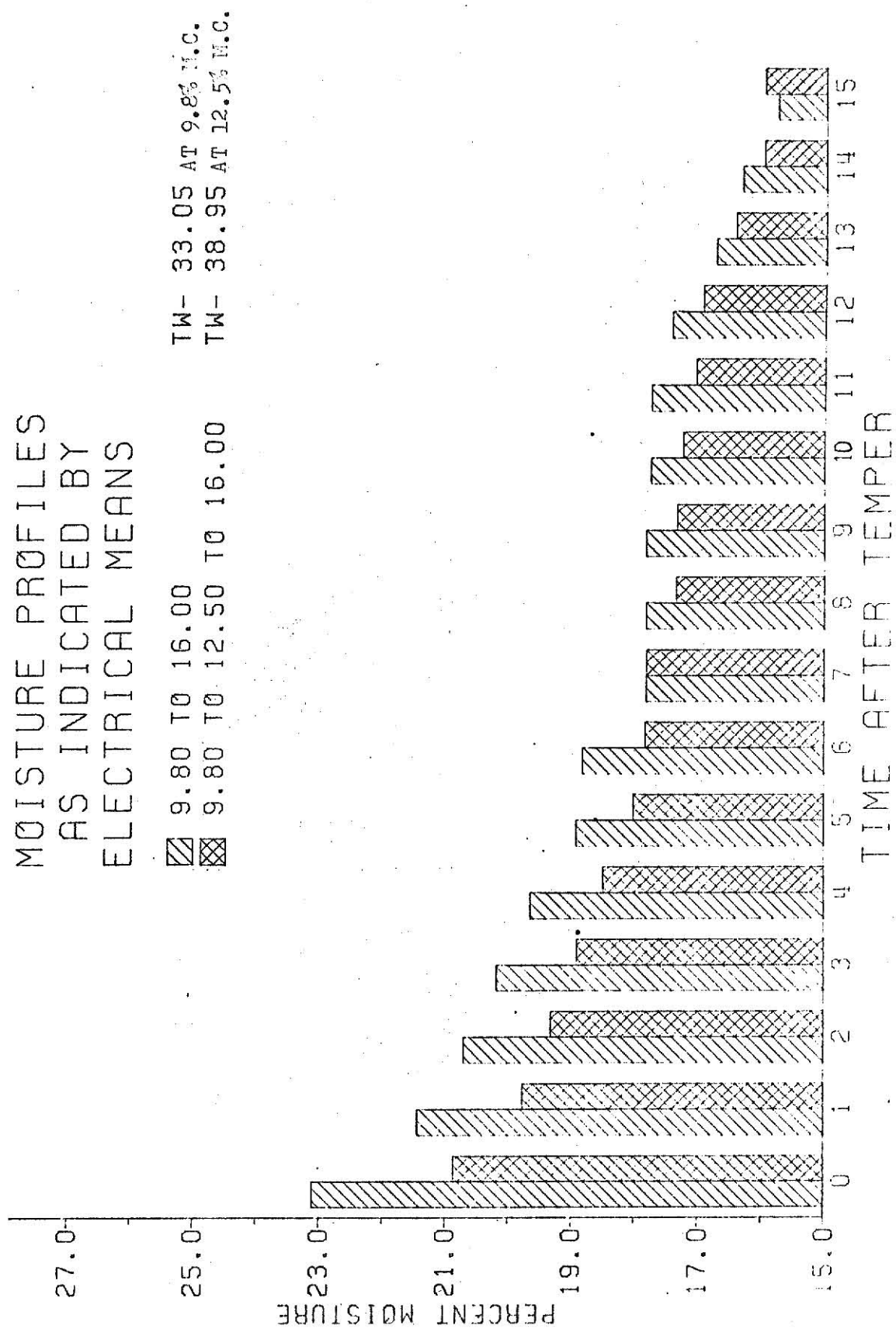


Figure 38. Oats one temper versus two temper by Tag-Heppertall.

Table 95. Rye raised from 12.0 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	19.39	19.30	19.47
1	18.12	18.29	17.94
2	17.17	17.43	16.90
3	16.54	16.39	16.68
4	16.60	16.51	16.68
5	16.51	16.51	16.51
6	16.35	16.18	16.51
7	16.18	16.18	16.18
8	16.18	16.18	16.18
9	16.01	16.01	16.01
10	16.01	16.01	16.01
11	15.93	15.84	16.01
12	15.84	15.84	15.84

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 96. Rye raised from 12.0 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	17.62	17.79	17.45
1	16.76	16.76	16.76
2	16.39	16.39	16.39
3	16.21	16.21	16.21
4	16.04	16.04	16.04
5	15.97	16.04	15.90
6	15.92	15.94	15.90
7	15.92	15.93	15.90
8	15.91	15.91	15.90
9	15.80	15.90	15.70
10	15.80	15.90	15.70
11	15.94	15.55	15.53
12	15.54	15.54	15.53

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

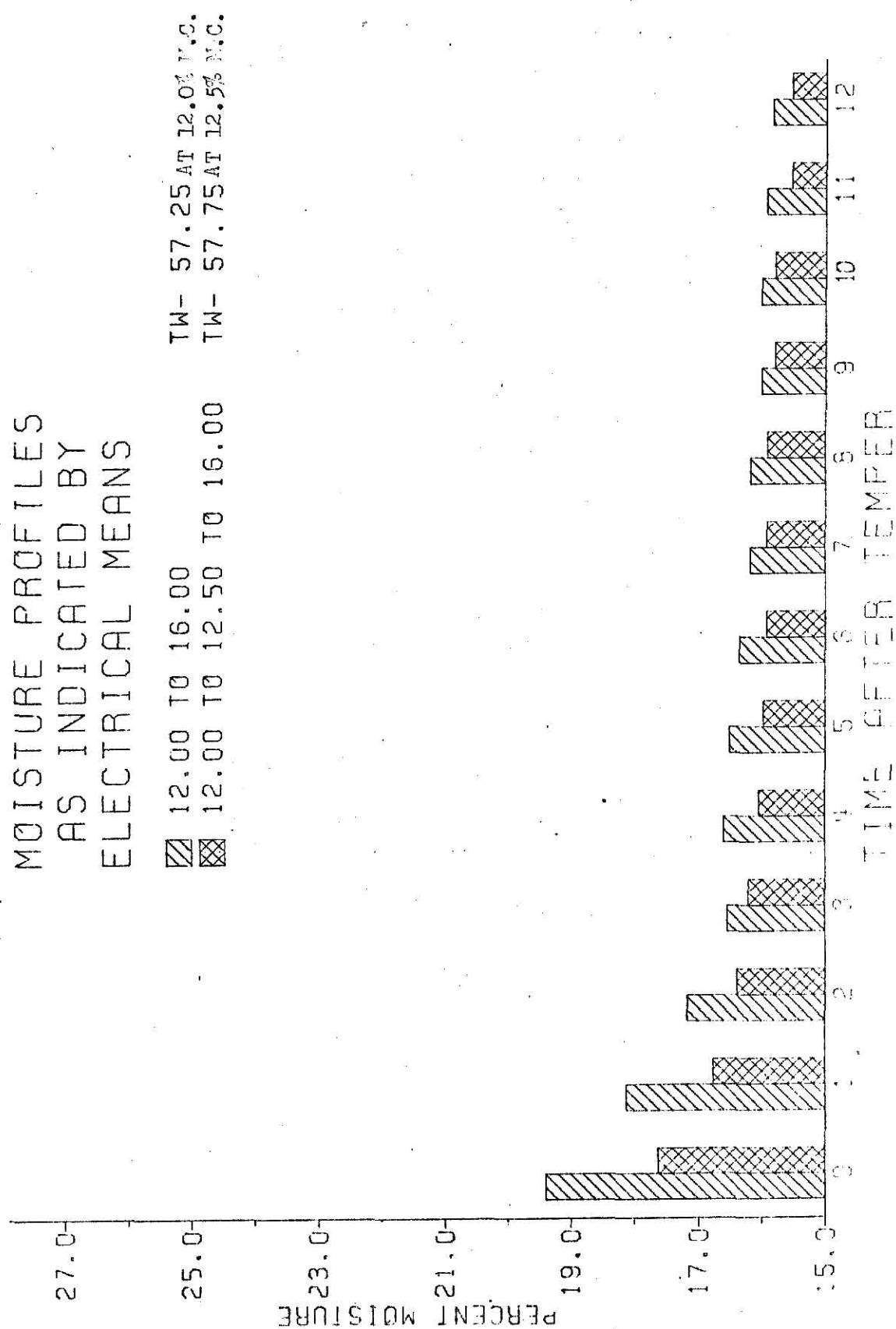


Figure 39. Rye one temper versus two temper by Motonco.

Table 97. Rye raised from 12.0 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	20.19	19.27	21.00
1	18.57	18.77	18.37
2	17.90	17.78	18.01
3	17.42	17.32	17.52
4	17.29	17.21	17.37
5	17.12	17.21	17.03
6	17.03	16.84	17.22
7	16.48	16.35	16.61
8	16.90	16.97	16.82
9	16.48	16.49	16.47
10	16.34	16.28	16.40
11	16.34	16.28	16.40
12	16.52	16.35	16.68

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 98. Rye raised from 12.0 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	19.10	19.41	18.79
1	17.70	17.79	17.61
2	17.45	17.34	17.55
3	17.25	17.35	17.14
4	16.88	17.20	16.56
5	16.57	16.74	16.40
6	16.50	16.46	16.54
7	16.26	16.32	16.19
8	16.01	15.90	16.12
9	16.36	16.67	16.05
10	16.08	16.04	16.12
11	15.88	16.18	15.58
12	16.08	16.18	15.98

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



MOISTURE PROFILES  
AS INDICATED BY  
ELECTRICAL MEANS

TW- 57.25 AT 12.0% M.C.  
 TW- 57.75 AT 12.5% M.C.

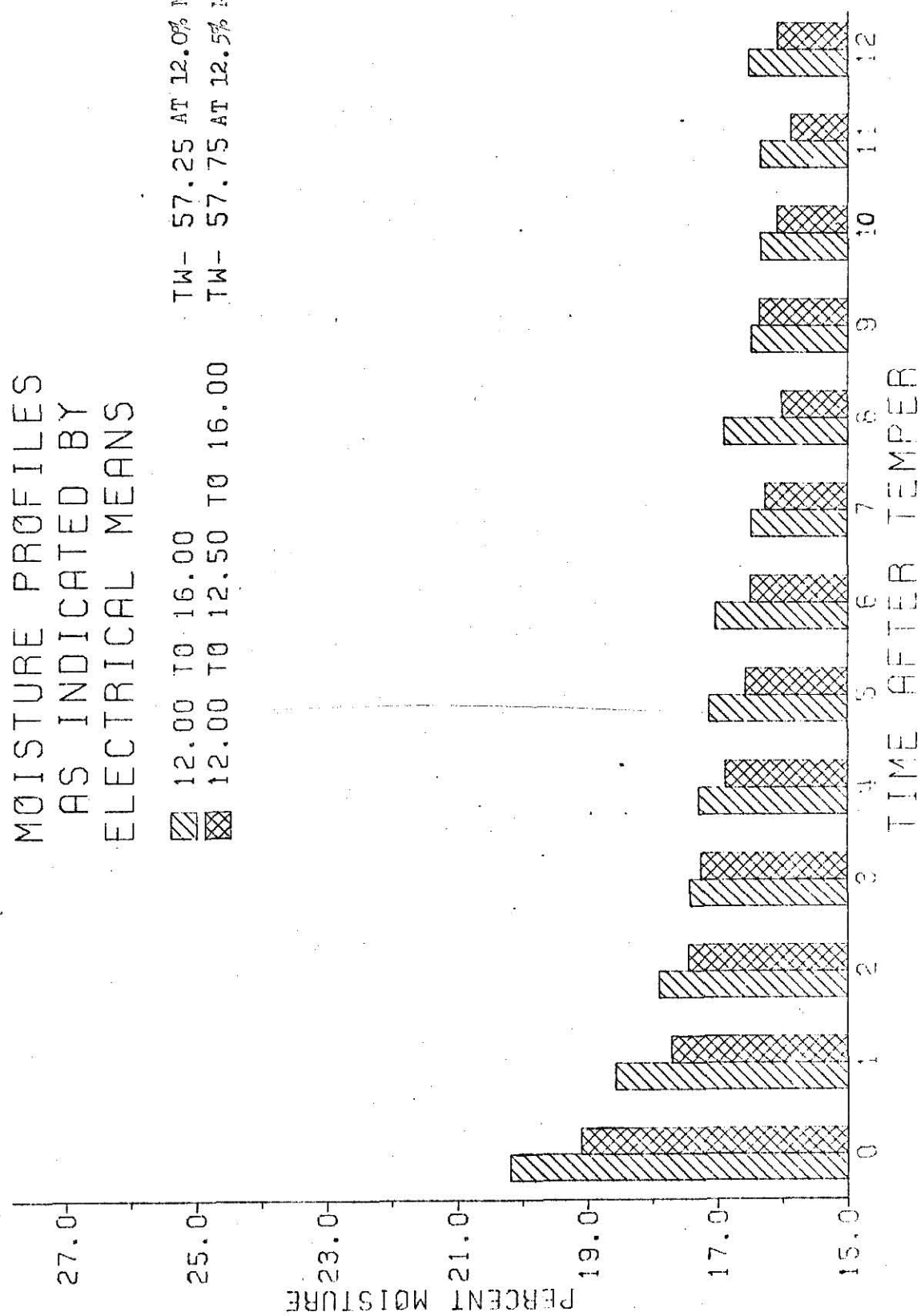


Figure 40. Re one temper versus two temper by Steinlite.

Table 99. Rye raised from 12.0 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	23.55	23.55	23.55
1	22.80	22.81	22.78
2	21.12	20.87	21.37
3	19.61	19.86	19.35
4	18.24	18.11	18.36
5	17.67	17.50	17.83
6	17.14	17.03	17.20
7	16.81	16.90	16.71
8	16.46	16.52	16.40
9	16.34	16.28	16.40
10	16.01	16.01	16.01
11	15.83	15.88	15.78
12	15.65	15.64	15.66

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 100. Rye raised from 12.0 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	23.04	23.15	22.93
1	21.23	21.05	21.40
2	19.75	19.86	19.64
3	18.32	18.49	18.14
4	17.53	17.53	17.53
5	17.08	17.08	17.08
6	16.55	16.55	16.55
7	16.31	16.31	16.31
8	15.88	16.04	15.72
9	15.68	15.69	15.67
10	15.67	15.69	15.65
11	15.51	15.45	15.56
12	15.51	15.45	15.56

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

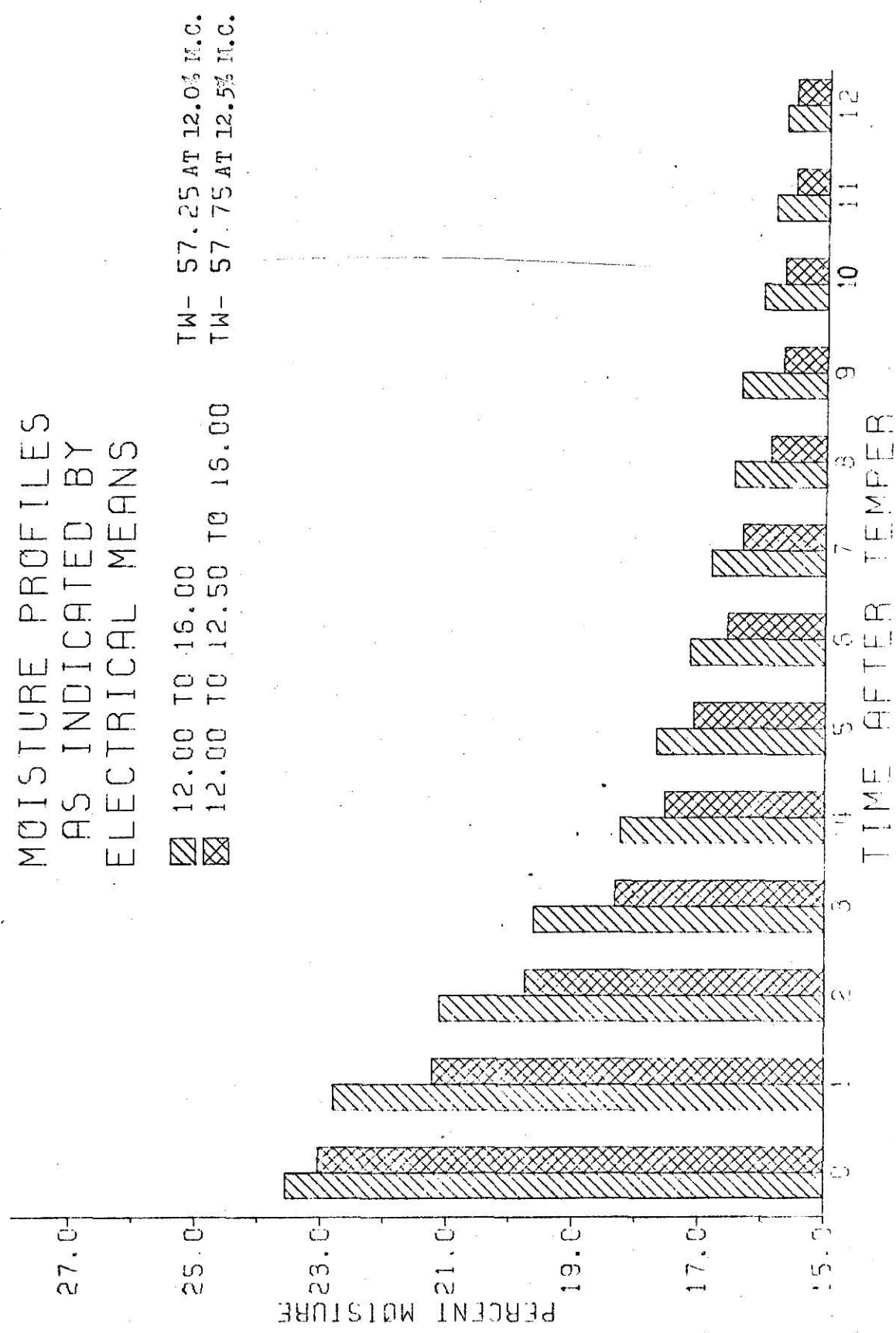


Figure 41. One temper versus two temper by Tan-Homonstall.

Table 101. Barley raised from 9.0 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	29.28	29.28+	29.28+
1	29.28	29.28+	29.28+
2	29.28	29.28+	29.28+
3	29.28	29.28+	29.28+
4	29.28	29.28+	29.28+
5	29.28	29.28+	29.28+
6	29.28	29.28+	29.28+
7	26.86	26.86	26.86
8	26.43	26.43	26.43
9	25.57	25.58	25.56
10	24.51	24.29	24.72
11	23.76	23.65	23.87
12	23.13	23.02	23.23
13	19.92	20.02	19.81
14	18.96	19.17	18.75

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 102. Barley raised from 9.0 to 12.5 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.94	25.04	24.83
1	23.87	24.19	23.55
2	22.76	22.28	23.23
3	21.94	22.26	21.62
4	21.41	21.41	21.41
5	21.30	21.41	21.19
6	20.66	20.75	20.56
7	20.11	20.11	20.11
8	19.69	19.90	19.47
9	19.05	19.05	19.05
10	18.95	19.05	18.84
11	18.84	18.84	18.84
12	18.74	18.84	18.63
13	17.75	17.75	17.75
14	17.43	17.53	17.32

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

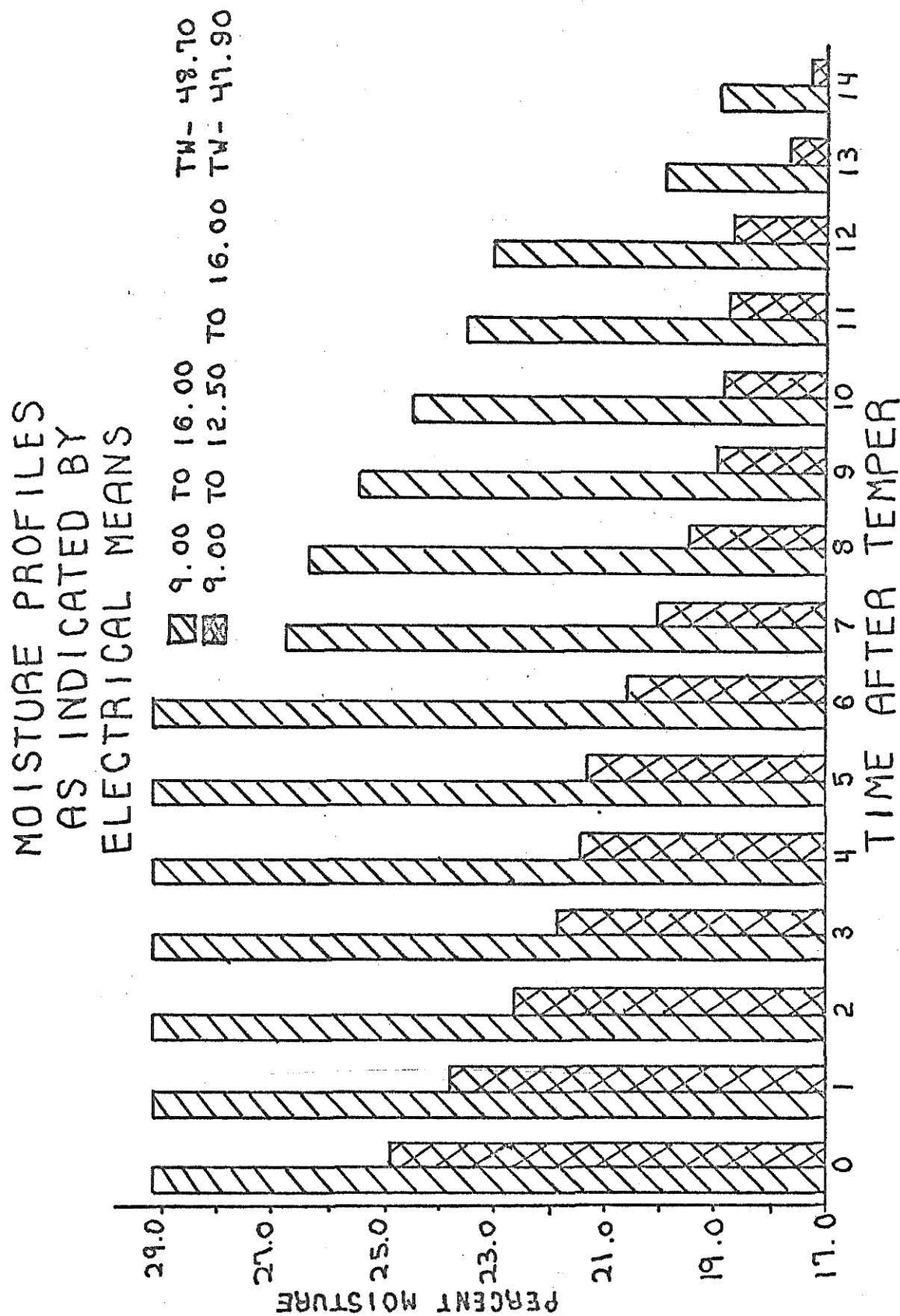


Figure 42. Barley one temper versus two temper by Motorola.

Table 103. Barley raised from 9.0 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	23.08	23.08+	23.08+
1	23.08	23.08+	23.08+
2	23.08	23.08+	23.08+
3	23.08	23.08+	23.08+
4	23.08	23.08+	23.08+
5	23.08	23.08+	23.08+
6	23.08	23.08+	23.08+
7	23.08	23.08+	23.08+
8	23.08	23.08+	23.08+
9	23.08	23.08+	23.08+
10	23.08	23.08+	23.08+
11	23.08	23.08+	23.08+
12	23.08	23.08+	23.08+
13	22.65	22.75	22.55
14	20.47	20.57	20.36

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 104. Barley raised from 9.0 to 12.5 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	23.08	23.08+	23.08+
1	23.08	23.08+	23.08+
2	23.08	23.08+	23.08+
3	23.08	23.08+	23.08+
4	23.08	23.08+	23.08+
5	22.78	22.50	22.66
6	22.27	22.35	22.19
7	22.03	22.35	21.70
8	21.55	21.66	21.43
9	20.91	21.33	20.49
10	20.59	21.07	20.10
11	20.24	20.79	19.68
12	20.02	20.10	19.93
13	19.48	19.54	19.42
14	18.16	18.40	17.91

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

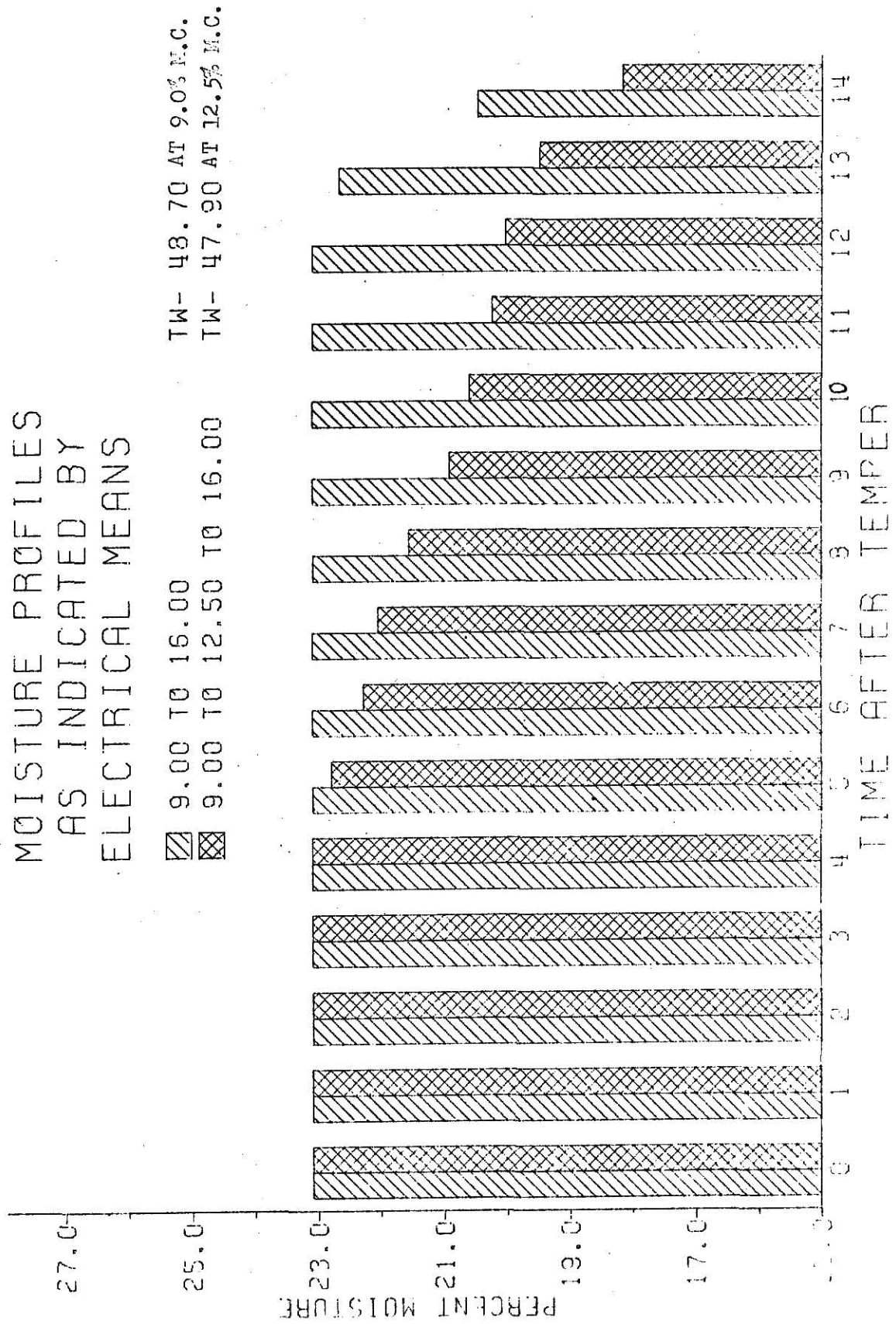


Figure 43. Barley one temper versus two temper by Steinlite.

Table 105. Barley raised from 9.0 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	23.82	23.82+	23.82+
1	23.82	23.82+	23.82+
2	23.82	23.82+	23.82+
3	23.82	23.82+	23.82+
4	23.82	23.82+	23.82+
5	23.82	23.82+	23.82+
6	24.00	24.00	24.00
7	23.28	23.50	23.05
8	22.61	22.61	22.61
9	22.18	22.19	22.16
10	21.52	21.74	21.30
11	21.30	21.30	21.30
12	20.87	20.87	20.87
13	18.51	18.51	18.51
14	16.92	17.09	16.75

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 106. Barley raised from 9.0 to 12.5 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	22.52	22.31	22.73
1	22.10	22.31	21.89
2	21.45	21.45	21.45
3	20.99	20.99	20.99
4	20.49	20.59	20.38
5	19.66	20.16	19.16
6	19.39	19.67	19.10
7	18.90	18.90	18.90
8	18.40	18.63	18.17
9	18.20	18.17	18.23
10	18.12	18.23	18.00
11	17.88	18.00	17.76
12	17.50	17.50	17.50
13	16.56	16.56	16.56
14	15.95	15.97	15.93

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.



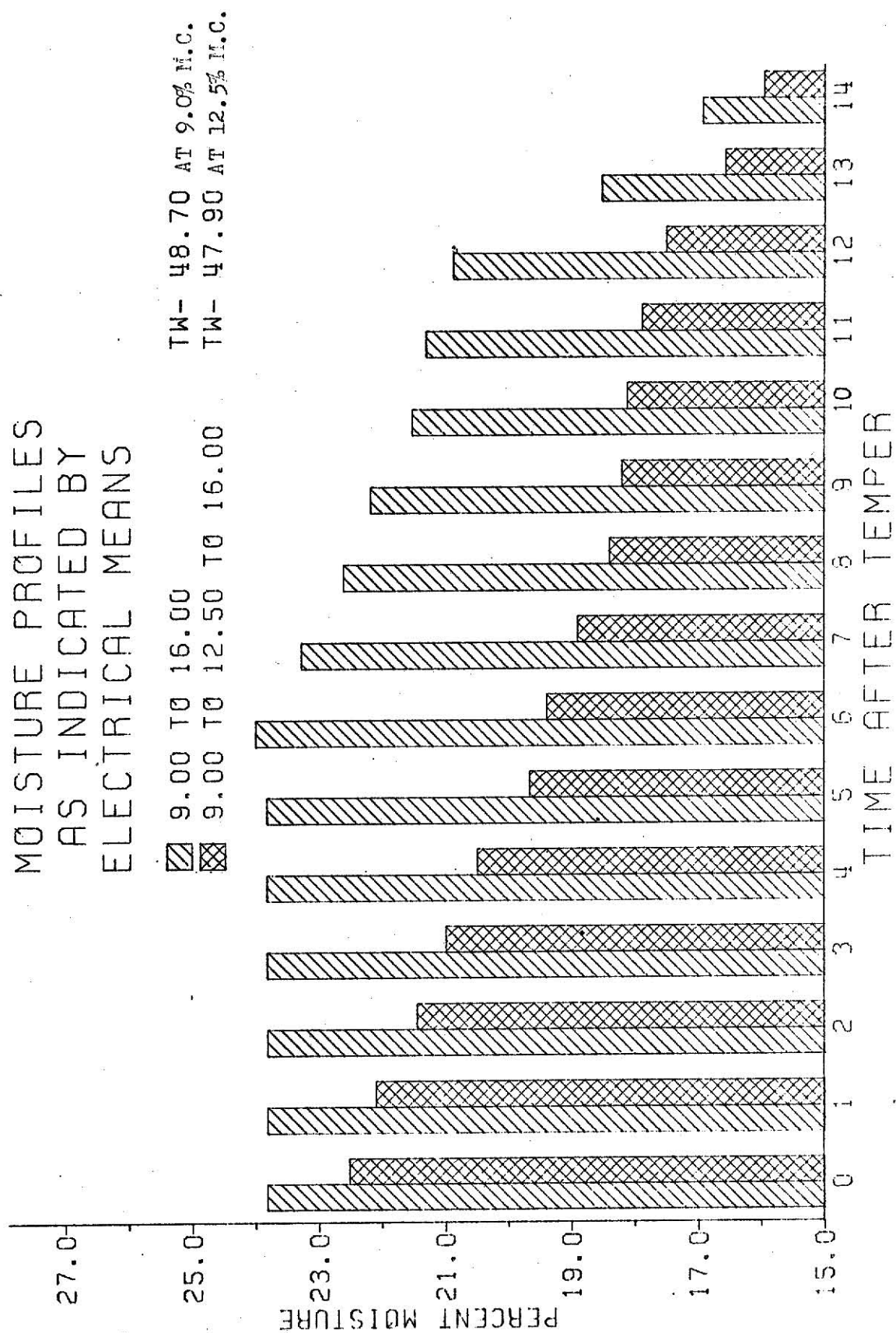


Figure 44. Barley one temper versus two temper by Tag-Heppenstall.

Table 107. Kansas Hard Red Winter Wheat (Sage at normal room temperature) raised from 10.2 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00*	24.00*
1	22.02	22.69	21.35
2	20.07	19.57	20.16
3	19.37	19.27	19.37
4	18.29	18.38	18.19
5	17.99	17.81	18.17
6	17.69	17.79	17.59
7	17.47	17.56	17.37
8	17.37	17.37	17.37
9	17.37	17.37	17.37
10	17.18	17.18	17.18
11	16.99	16.99	16.99
12	16.99	16.99	16.99
13	16.03	16.03	16.03

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 108. Kansas Hard Red Winter Wheat (Sage heated to 110°F) raised from 9.8 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	20.92	21.26	20.58
1	19.14	19.48	18.80
2	17.92	18.27	17.56
3	17.58	17.70	17.46
4	16.95	17.07	16.82
5	16.76	16.69	16.83
6	16.76	16.69	16.83
7	16.67	16.69	16.64
8	16.57	16.49	16.64
9	16.52	16.54	16.49
10	16.44	16.56	16.32
11	16.28	16.21	16.35
12	16.21	16.21	16.21
13	16.17	16.17	16.17

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

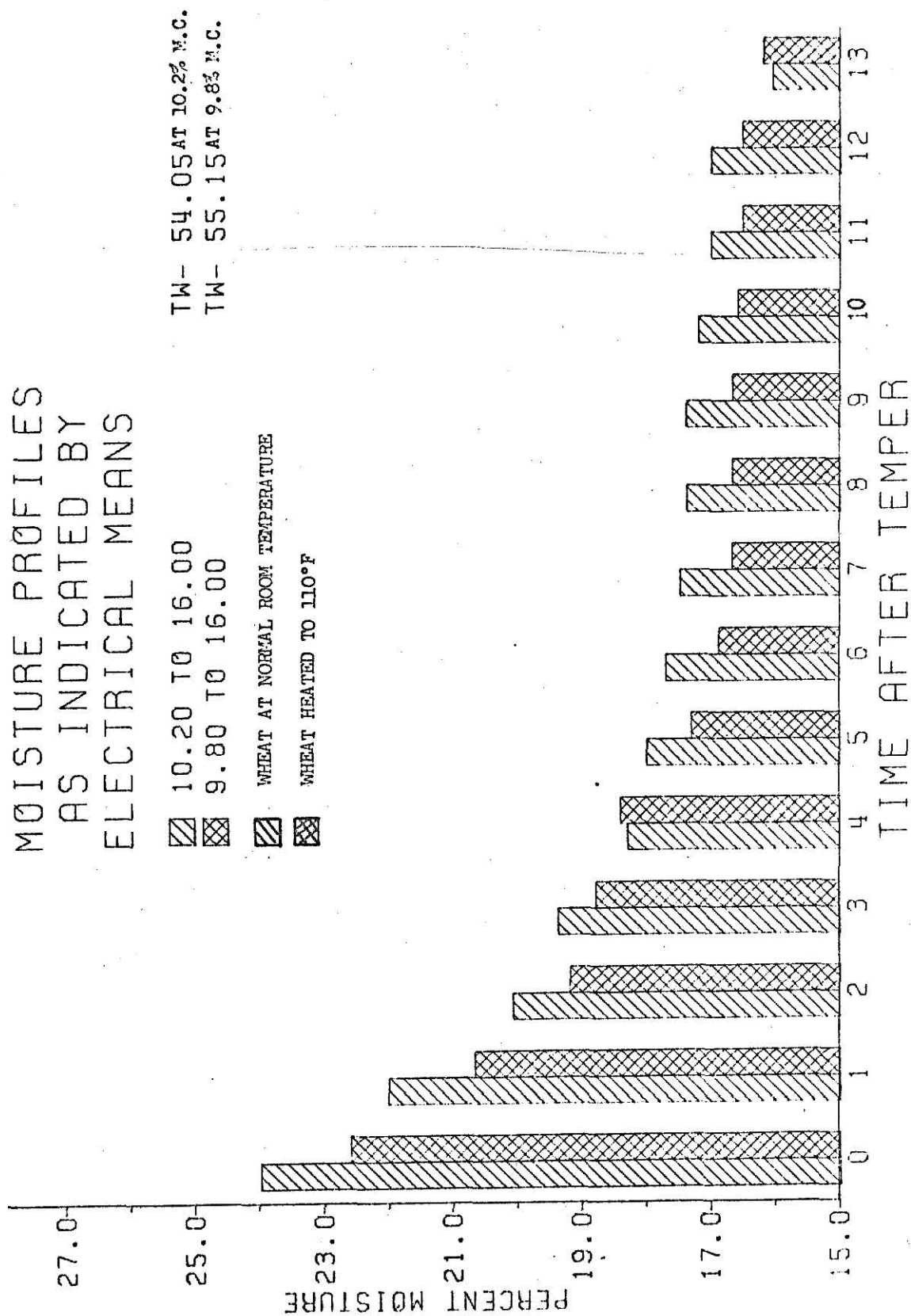


Figure 45. Kansas Hard Red Winter Wheat (Sage) one temper hot wheat treatment versus one temper cold wheat treatment by Notomco.

Table 109. Kansas Hard Red Winter Wheat (Sage at normal room temperature) raised from 10.2 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	23.82	23.96	23.67
2	22.41	22.61	22.20
3	20.89	21.21	20.56
4	19.63	19.97	19.29
5	19.34	19.46	19.21
6	19.18	19.20	19.15
7	18.70	18.83	18.54
8	18.47	18.66	18.28
9	18.56	18.48	18.63
10	18.49	18.48	18.49
11	18.19	18.13	18.25
12	18.14	18.13	18.14
13	17.78	17.78	17.78

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 110. Kansas Hard Red Winter Wheat (Sage heated to 110°F) raised from 9.8 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.50	23.07	21.92
1	20.62	21.14	20.09
2	18.90	19.51	18.29
3	18.43	18.47	18.39
4	18.39	18.84	17.94
5	18.50	18.39	18.60
6	18.34	18.29	18.28
7	18.23	18.18	18.28
8	17.88	17.90	17.86
9	17.79	18.09	17.49
10	17.82	17.91	17.72
11	17.74	17.93	17.54
12	17.57	17.62	17.52
13	17.44	17.31	17.56

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

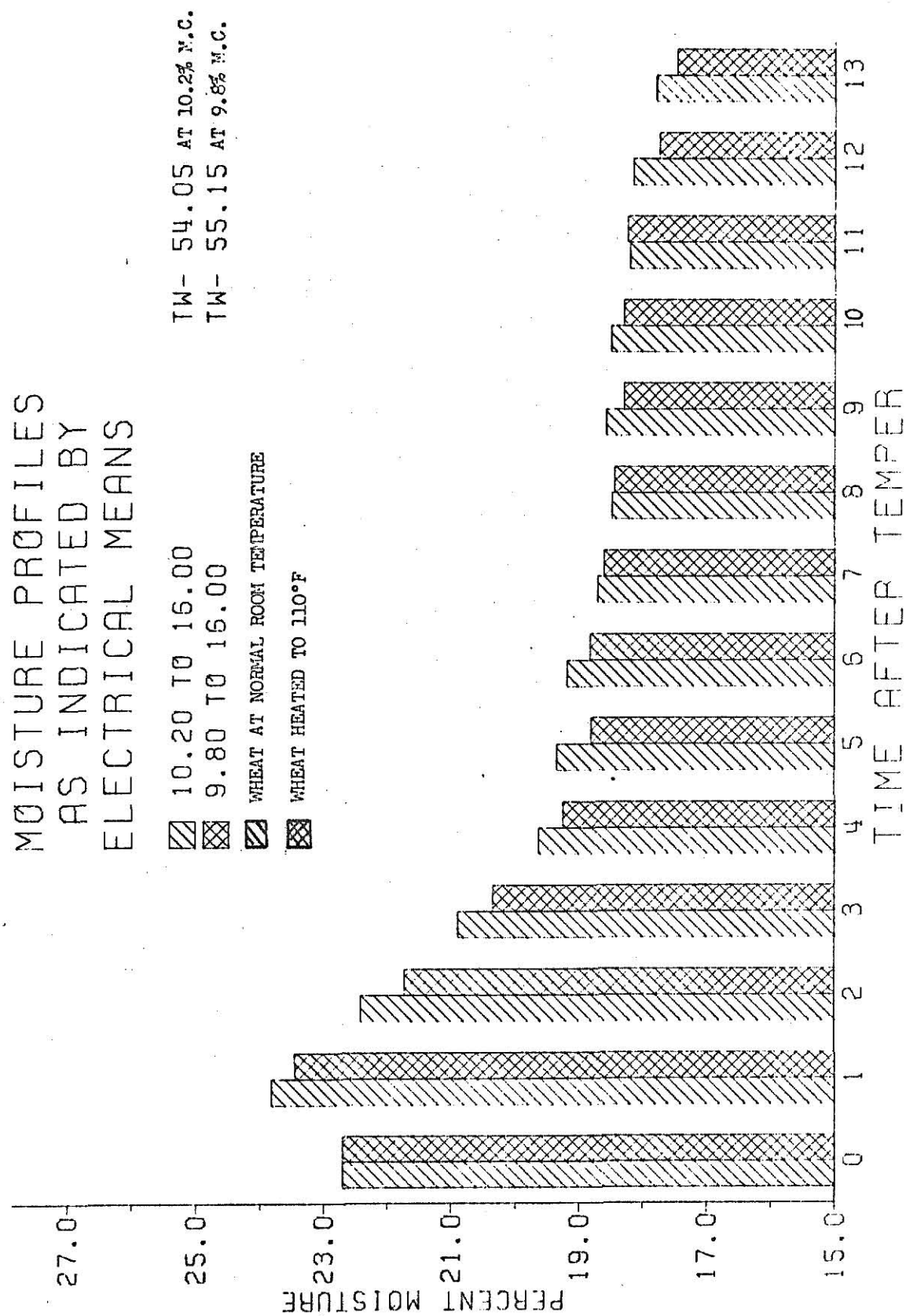


Figure 46. Kansas Hard Red Winter Wheat (Sare) one temper hot wheat treatment versus one temper cold wheat treatment by Steinlite.

Table 111. Kansas Hard Red Winter Wheat (Sage at normal room temperature) raised from 10.2 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	22.06	22.81	21.41
4	20.53	20.68	20.38
5	19.56	19.61	19.51
6	19.09	18.28	18.90
7	18.51	18.67	18.35
8	18.00	18.07	17.92
9	17.65	17.77	17.53
10	17.44	17.44	17.44
11	17.25	17.25	17.25
12	17.07	17.07	17.07
13	16.22	16.22	16.22

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 112. Kansas Hard Red Winter Wheat (Sage heated to 110°F) raised from 9.8 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	22.32	22.88	21.76
2	19.57	20.17	18.97
3	18.72	19.03	18.41
4	18.03	18.26	17.80
5	17.46	17.71	17.20
6	17.10	17.26	16.93
7	16.82	16.89	16.74
8	16.59	16.71	16.46
9	16.44	16.58	16.29
10	16.36	16.49	16.22
11	16.14	16.20	16.07
12	16.10	16.13	16.06
13	15.84	15.84	15.83

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

# MOISTURE PROFILES AS INDICATED BY ELECTRICAL MEANS

TW- 54.05 AT 10.2% M.C.  
TW- 55.15 AT 9.8% M.C.

10.20 TO 16.00

9.80 TO 16.00

WHEAT AT NORMAL ROOM TEMPERATURE

WHEAT HEATED TO 110°F

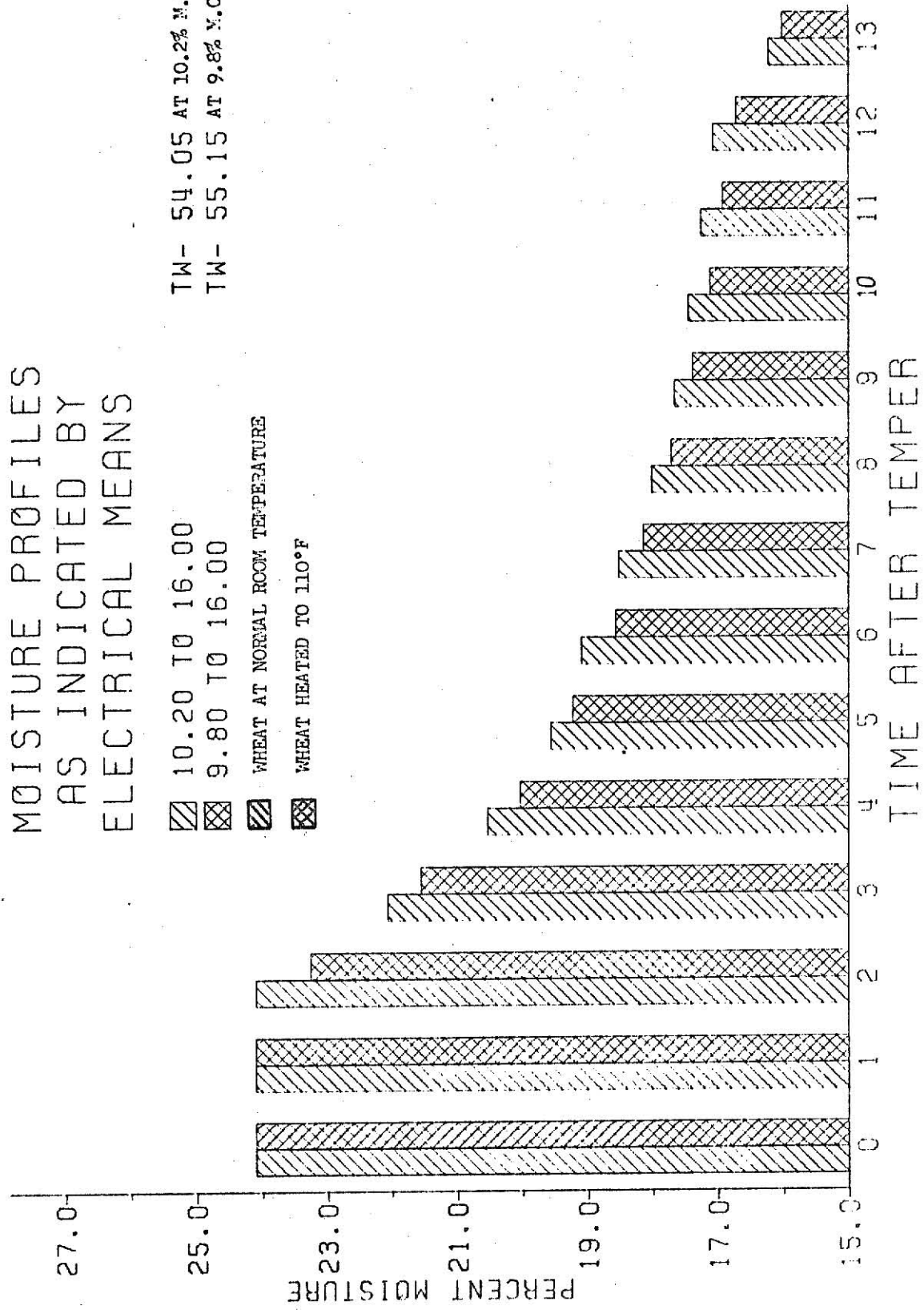


Figure 47. Kansas Hard Red Winter Wheat (Sage) one temper hot wheat treatment versus one temper cold wheat treatment by Tag-Heppenstall.

Heated Water. Results from testing Kansas Hard Red Winter Wheat (Sage) with heated water are presented in Tables 114, 116 and 118. The water was heated to 110°F prior to tempering the grain. Tests were made with one temper and compared to normally tempered wheat (Tables 113, 115 and 117) graphically (Figures 48, 49 and 50). The rate of water penetration was significantly greater for the heated water treatment than for the normal tap water treatment. Dedrick (19) found that wheat treated with warm water would absorb moisture or water more rapidly than when treated in the same manner with cold water.

One-Half Grain Treatment. Results from testing Kansas Hard Red Winter Wheat (Sage) by adding the total calculated amount of water to only half of total required grain with remaining grain being mixed in are presented in Tables 119, 121 and 123. The total calculated amount of required temper water was added to only half of the grain with the remaining half being slowly mixed in. Tests were made with one temper and compared to normally tempered wheat (Tables 120, 122 and 124) graphically (Figures 51, 52 and 53). There was a significant increase in rate of water penetration for the one-half grain treatment over the normally tempered grain. Fairbrother (21) discovered earlier that when wet and dry grains were mixed in equal quantities and allowed to lie together, moisture was transferred from the wet to the dry. He did find by careful analysis that equality of moisture was not attained though, with there being a final difference of about 2.0% between the mixed wheats.



Table 113. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture with room temperature water indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	22.02	22.69	21.35
2	20.07	19.97	20.16
3	19.37	19.37	19.37
4	18.29	18.38	18.19
5	17.99	17.81	18.17
6	17.69	17.79	17.59
7	17.47	17.56	17.37
8	17.37	17.37	17.37
9	17.37	17.37	17.37
10	17.18	17.18	17.18
11	16.99	16.99	16.99
12	16.99	16.99	16.99
13	16.03	16.03	16.03

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 114. Kansas Hard Red Winter Wheat (Sage) raised from 9.8 to 16.0 per cent moisture with 110°F water indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	22.61	22.61	22.61
1	20.67	21.07	20.26
2	19.19	19.29	19.08
3	18.78	19.08	18.47
4	18.40	19.21	17.49
5	17.30	17.30	17.30
6	16.87	17.03	16.66
7	16.66	16.66	16.66
8	16.66	16.66	16.66
9	16.66	16.66	16.66
10	16.57	16.66	16.47
11	16.50	16.52	16.47
12	16.50	16.52	16.47
13	16.18	16.22	16.13

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

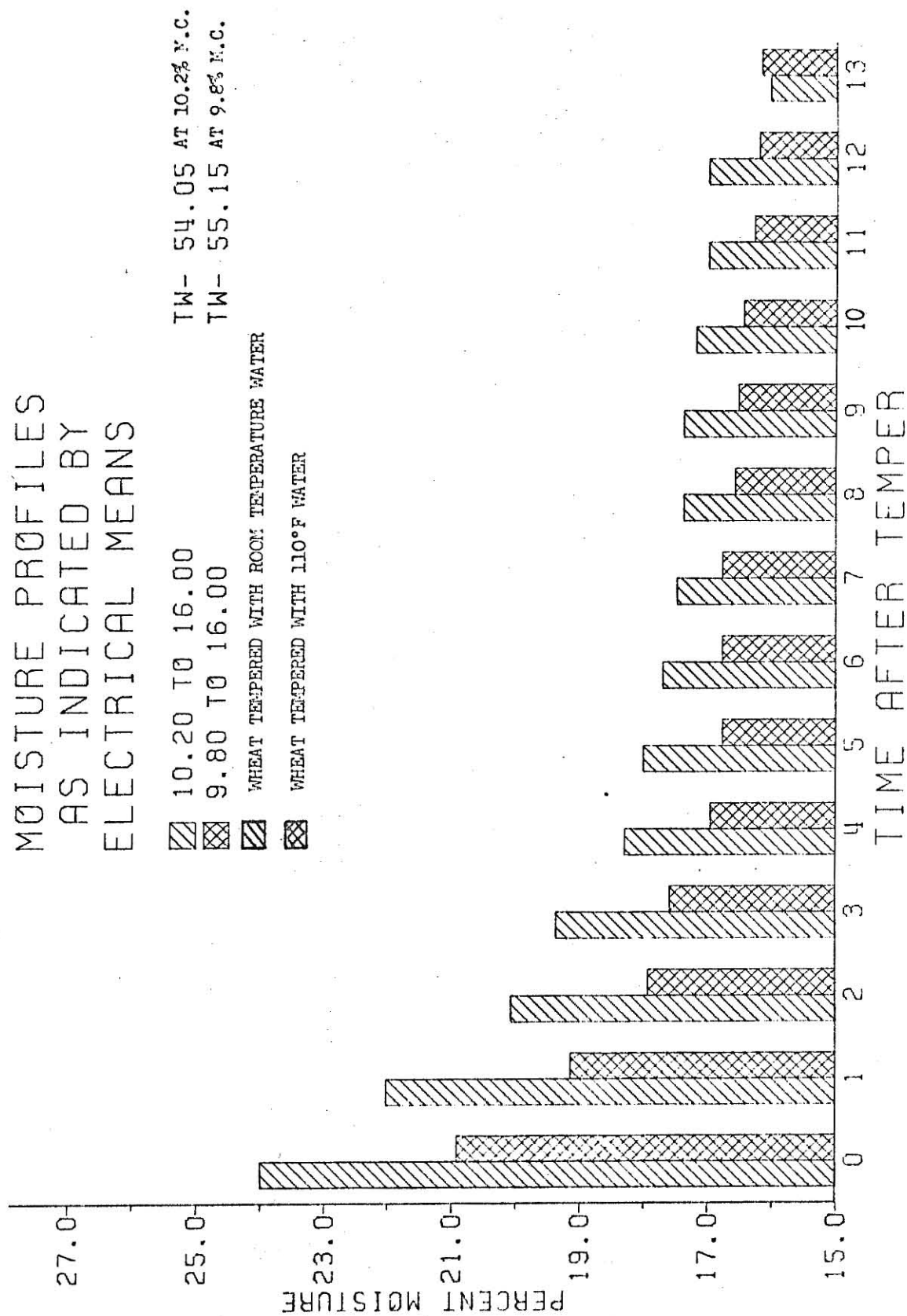


Figure 48. Kansas Hard Red Winter Wheat (Sage) one temper hot water treatment versus one temper cold water treatment by Motonco.

Table 115. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture with room temperature water indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	23.82	23.96	23.67
2	22.41	22.61	22.20
3	20.89	21.21	20.56
4	19.63	19.97	19.29
5	19.34	19.46	19.21
6	19.18	19.20	19.15
7	18.70	18.83	18.56
8	18.47	18.66	18.28
9	18.56	18.48	18.62
10	18.49	18.48	18.49
11	18.19	18.13	18.25
12	18.14	18.13	18.14
13	17.78	17.78	17.76

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 116. Kansas Hard Red Winter Wheat (Sage) raised from 9.8 to 16.0 per cent moisture with 110°F water indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	23.45	23.75	23.14
2	21.72	22.10	21.33
3	20.35	20.97	19.73
4	19.25	19.87	18.62
5	18.80	18.49	19.11
6	18.82	18.92	18.71
7	18.60	18.70	18.50
8	18.43	18.56	18.29
9	18.29	18.28	18.29
10	18.29	18.28	18.29
11	18.22	18.28	18.15
12	17.73	17.79	17.66
13	17.46	17.49	17.43

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

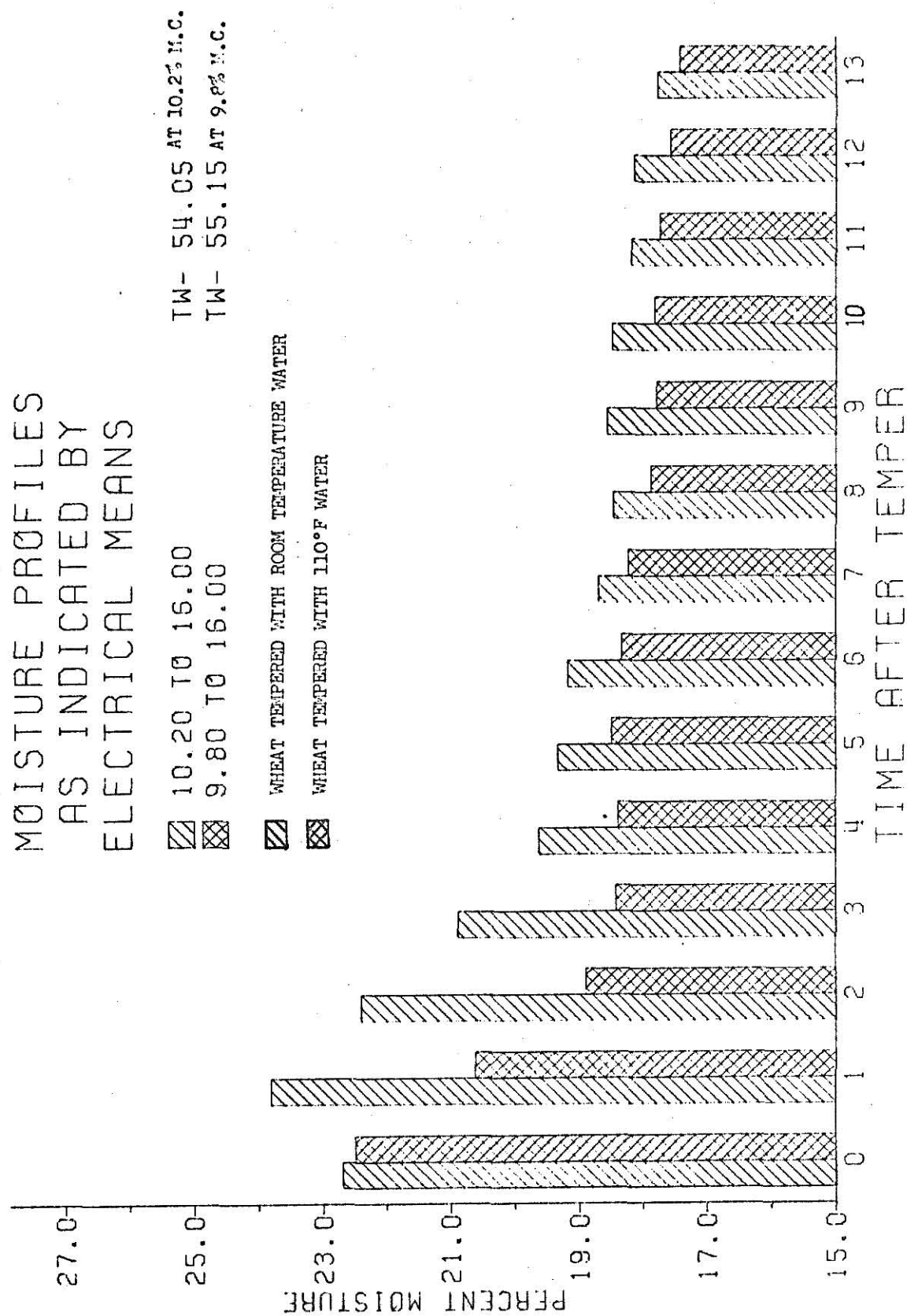


Figure 49. Kansas Hard Red Winter Wheat (Sage) one temper hot water treatment versus one temper cold water treatment by Steinlite.

Table 117. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture with room temperature water indicated by Tag-Hennenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	22.06	22.81	21.21
4	20.53	20.68	20.38
5	19.56	19.61	19.51
6	19.09	19.28	18.90
7	18.51	18.67	18.35
8	18.00	18.07	17.92
9	17.65	17.77	17.53
10	17.44	17.44	17.44
11	17.25	17.25	17.25
12	17.07	17.07	17.07
13	16.22	16.22	16.22

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 118. Kansas Hard Red Winter Wheat (Sage) raised from 9.8 to 16.0 per cent moisture with 110°F water indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	23.26	23.42	23.09
3	21.55	22.09	21.01
4	20.03	20.59	19.46
5	19.22	19.46	18.98
6	18.56	18.80	18.32
7	18.13	18.32	17.93
8	17.70	17.92	17.47
9	17.38	17.55	17.20
10	17.11	17.29	16.92
11	16.92	17.01	16.83
12	16.72	16.83	16.61
13	16.02	15.97	16.07

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

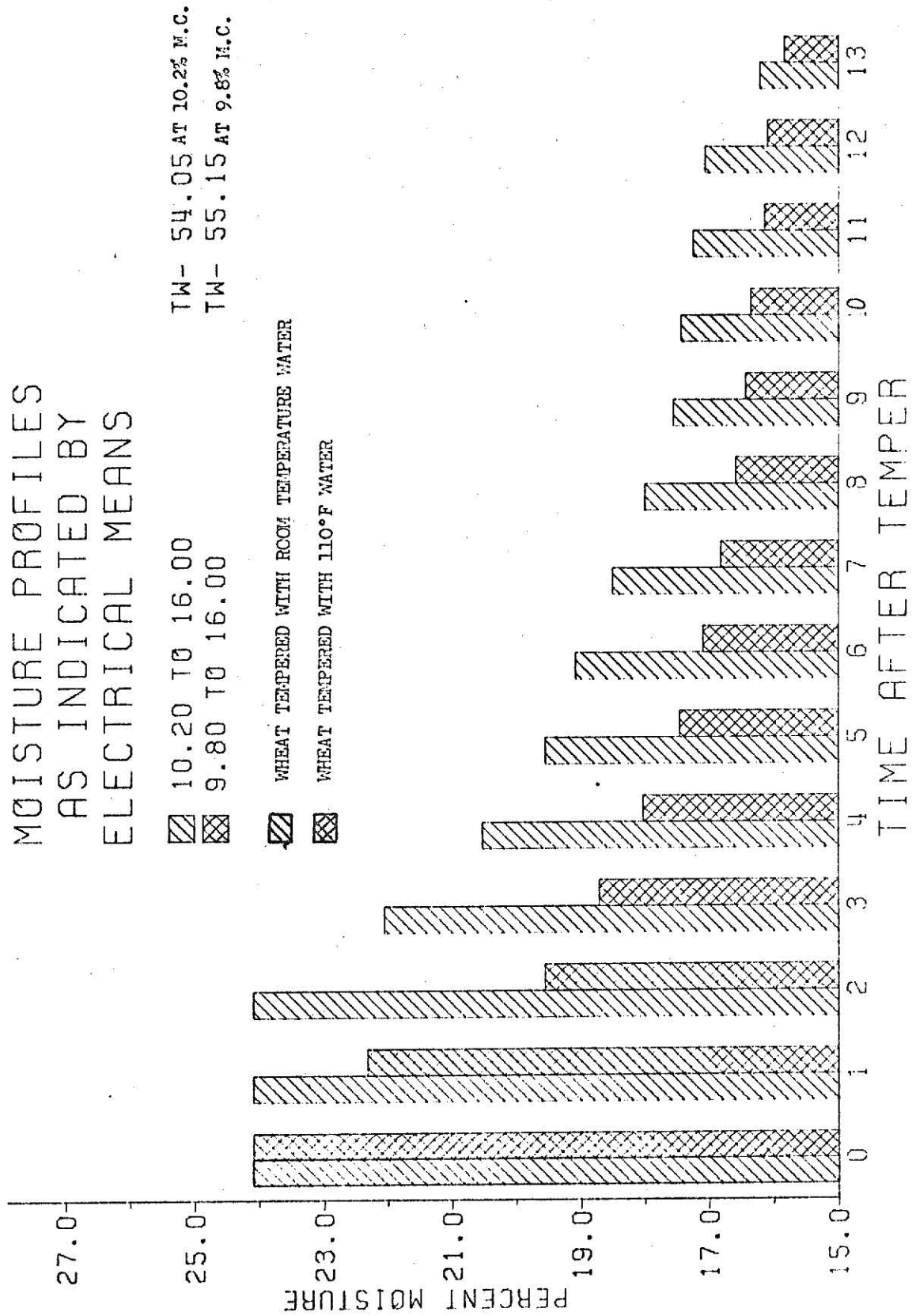


Figure 50. Kansas Hard Red Winter Wheat (Sage) one temper hot water treatment versus one temper cold water treatment by Tar-Heppenstall.

Table 119. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture showing effect of one half weighed wheat quantity receiving temper water with remaining one half mixed in indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	20.96	20.77	21.15
1	19.73	19.42	19.04
2	18.45	18.46	18.43
3	17.75	18.05	17.45
4	16.56	16.87	17.04
5	16.79	16.74	16.84
6	16.45	16.46	16.44
7	16.35	16.25	16.44
8	16.22	16.22	16.22
9	16.22	16.22	16.22
10	16.22	16.22	16.22
11	16.08	16.03	16.13
12	16.03	16.03	16.03

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 120. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture indicated by Motomco.

TIME	MEAN	TEST 1	TEST 2
0	24.00	24.00+	24.00+
1	22.02	22.69	21.35
2	20.07	19.97	20.16
3	19.37	19.37	19.37
4	18.29	18.38	18.19
5	17.99	17.81	18.17
6	17.69	17.79	17.59
7	17.47	17.56	17.37
8	17.37	17.37	17.37
9	17.37	17.37	17.37
10	17.18	17.18	17.18
11	16.99	16.99	16.99
12	16.99	16.99	16.99

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

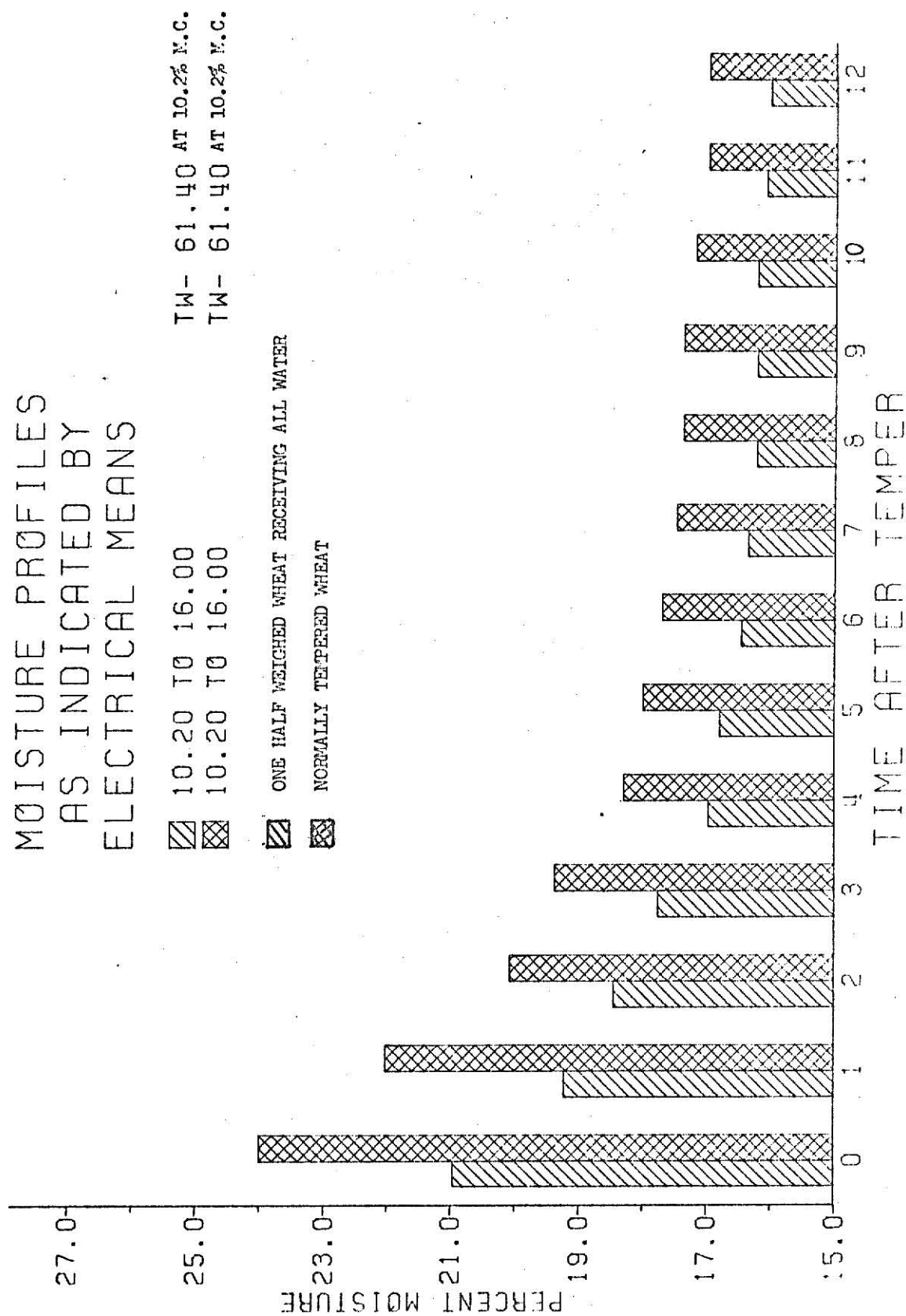


Figure 51. Kansas Hard Red Winter Wheat (Sage) one half weighed wheat quantity receiving temper water with remaining one half mixed in versus total quantity temper by Motorco.



Table 121. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture showing effect of one half weighed wheat quantity receiving temper water with remaining one half mixed in indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	23.72	23.70	23.74
1	22.00	22.07	21.92
2	20.83	20.81	20.84
3	19.16	19.62	18.69
4	18.73	18.77	18.69
5	18.12	18.25	17.99
6	17.59	17.55	17.62
7	17.34	17.27	17.41
8	17.37	17.29	17.45
9	17.48	17.43	17.52
10	17.05	16.72	17.38
11	17.11	17.06	17.15
12	17.03	17.06	16.99

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 55% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 122. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture indicated by Steinlite.

TIME	MEAN	TEST 1	TEST 2
0	22.70	22.70+	22.70+
1	23.82	23.67	23.96
2	22.41	22.20	22.61
3	20.89	20.56	21.21
4	19.63	19.29	19.97
5	19.34	19.21	19.46
6	19.18	19.15	19.20
7	18.70	18.56	18.83
8	18.47	18.28	18.66
9	18.56	18.63	18.48
10	18.49	18.49	18.48
11	18.19	18.25	18.13
12	18.14	18.14	18.13

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

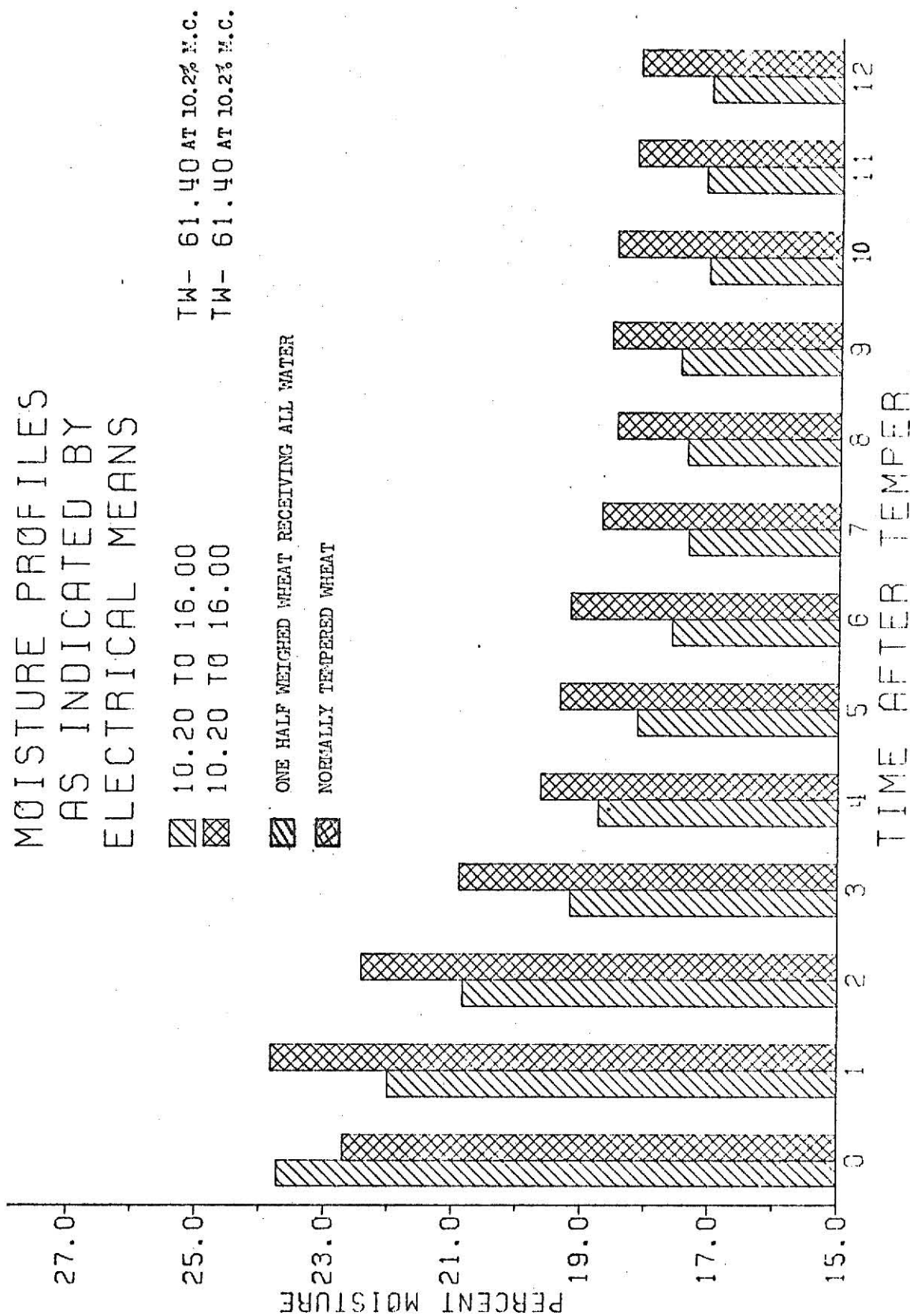


Figure 52. Kansas Hard Red Winter Wheat (Sage) one half weighed wheat quantity receiving temper water with remaining one half mixed in versus total quantity temper by Steinlite.

Table 123. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture showing effect of one half weighed wheat quantity receiving temper water with remaining one half mixed in indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	23.21	23.57	22.84
3	21.38	21.74	21.01
4	19.99	20.13	19.84
5	18.98	19.13	18.83
6	18.32	18.53	18.10
7	17.73	17.65	17.80
8	17.30	17.35	17.25
9	16.93	16.98	16.88
10	16.77	16.77	16.77
11	16.44	16.44	16.44
12	16.22	16.22	16.22

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

Table 124. Kansas Hard Red Winter Wheat (Sage) raised from 10.2 to 16.0 per cent moisture indicated by Tag-Heppenstall.

TIME	MEAN	TEST 1	TEST 2
0	24.10	24.10+	24.10+
1	24.10	24.10+	24.10+
2	24.10	24.10+	24.10+
3	22.06	21.31	22.81
4	20.53	20.38	20.68
5	19.56	19.51	19.61
6	19.09	18.90	19.28
7	18.51	18.35	18.67
8	18.00	17.92	18.07
9	17.65	17.53	17.77
10	17.44	17.44	17.44
11	17.25	17.25	17.25
12	17.07	17.07	17.07

AN ASTRIK IS PLACED AT ANY TEST READING WHICH DOES NOT FALL WITHIN A 95% CONFIDENCE INTERVAL ABOUT THE MEAN TEST READING.

A PLUS IS PLACED AT ANY TEST READING WHICH WENT OFF THE SCALE.

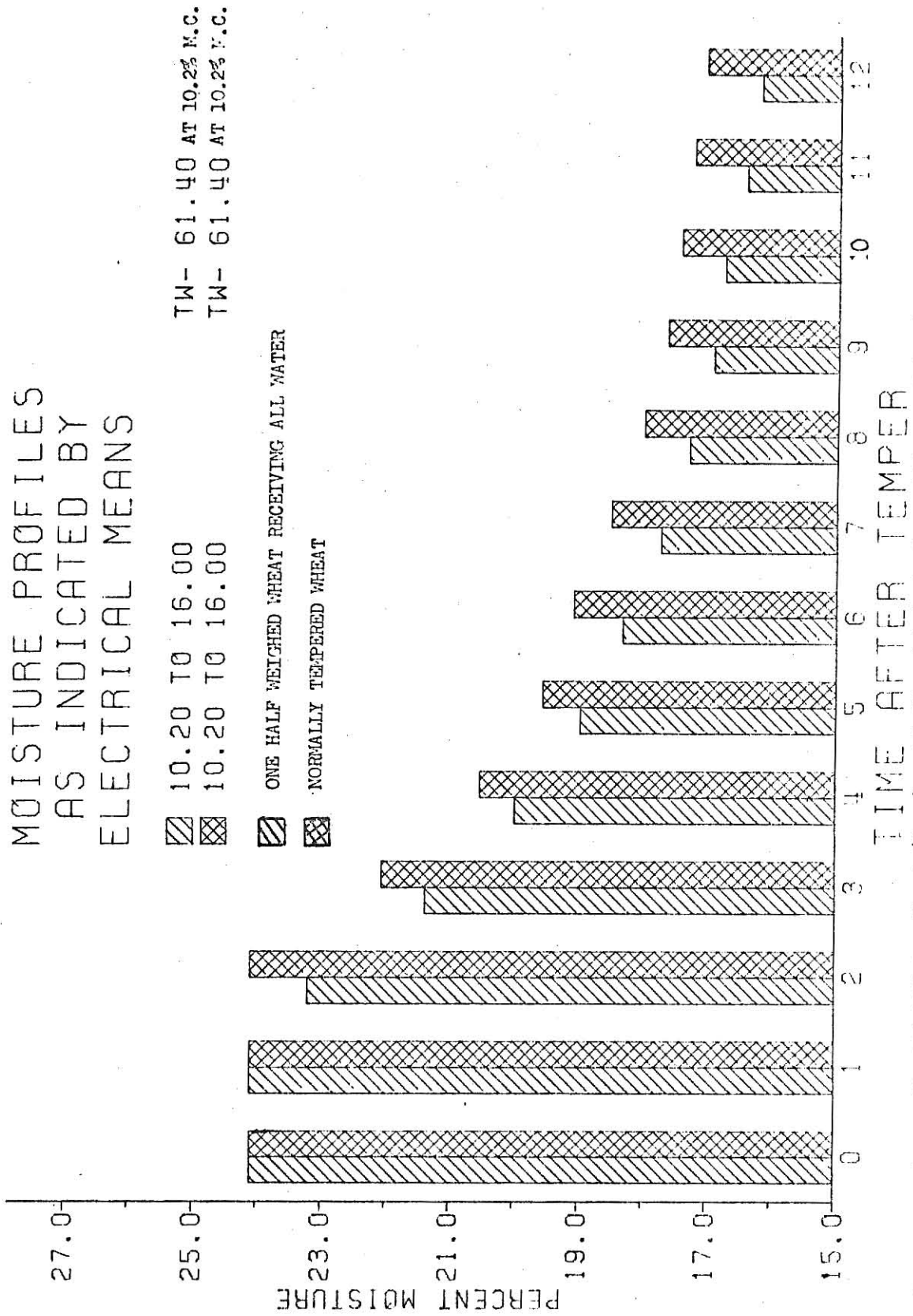


Figure 53. Kansas Hard Red Winter Wheat (bare) one half weiche wheat quantity receiving temper water with remaining one half mixed in versus total quantity temper by Tap-Herpenstall.

## SUMMARY AND CONCLUSIONS

It was the purpose of this investigation to develop moisture profiles for different small grains as indicated by each of three different moisture meters. Two tempering procedures were compared for each type of grain to show different rates of initial water penetration into grain. These two procedures were: tempering of the grains in one temper and tempering of the grains in two tempers. The different grains were tempered to desired milling moisture for most mills which did deviate from 16.0% for some of the tested small grains.

The series of experiments were performed, using the Motomco, Steinlite, Tag-Heppenstall and Brown Duvel moisture meters. In each series the calibration of each instrument was checked according to the manufacturers manual.

Drawing conclusions from the observations under the conditions which the experiments were performed it was established that the two temper systems gave the greater rate of water penetration with the second temper over the one temper system. The rate of water penetration varied for the different types of grains and among the different varieties of the same type grain.

At this stage of testing, concluding that either the one temper or the two temper system would yield better milling results is impossible. Milling data would need to be taken in order to make such a conclusion. But in considering the possibility of having water movement within rest bins due to gravity, it can be concluded that under the conditions under which the experiments were performed the two temper system would probably be the more preferable means of moisture addition.

## SUGGESTIONS FOR FUTURE WORK

Possibilities for future work may include the continuation of this research with emphasis on the following:

1). The two temper system showed an increased rate of water penetration. Milling results should be evaluated to determine if there is a significant difference between the tempering systems.

2). Comparison of milling results obtained by varying the temper time of the second phase of the two temper system. This analysis might introduce the possibility of a commercial mill using the two temper method without altering their present tempering system.

## ACKNOWLEDGEMENTS

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MOISTURE PROFILES OF SEVERAL GRAINS  
AS INDICATED BY ELECTRICAL MEANS

by

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B.S., University of Tennessee, 1969

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AN ABSTRACT OF A MASTER'S THESIS

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Small grains differ in size, shape and ease of permeability. This difference is of great importance in the area of milling. Not only does a miller desire a high total yield of good quality patent flour, but also to get this desired result with the minimum amount of power consumption possible.

The objective of this study is to show how fast the added water during the tempering of grain is picked up and absorbed during the very early hours after adding the required amount of water for milling.

It is shown graphically that the rate of water penetration is increased by the two temper stage rather than one temper; especially in the very dry, hard vitreous grains.

The grain could be raised to 12.5% moisture content (except for corn which was raised to 15.0%) with the first temper and held indefinitely without any occurring damage to the grains in question; to be raised to the final desired milling content with the second temper.

Tempering time should also be less when using the two temper stage. If the water can enter the kernel faster; then it can mellow the endosperm faster. Tests have shown that the mellowing phase is required in order to properly reduce the endosperm easily in the reduction system with the least amount of pressure.

Concluding that either the one temper or the two temper system would yield better milling results is impossible. Milling data would have to be taken in order to make such a conclusion. But in considering the possibility of having water movement within rest bins due to gravity, it can be concluded that under the conditions which the experiments were performed the two temper system would probably be the most preferable means of moisture addition.