ELECTRICAL CONDUCTIVITIES OF SORGHUM JUICES IN RELATION TO CHINCH BUG INJURY

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The Department of Agricultural Chemistry Research is engaged in a comprehensive study of the chemical factors which might be involved in the resistence of grain sorghum plants to chinch bug injury. Many chemical analyses have been made of whole plants and of separate portions of the plant from both resistant and susceptible varieties. Included in the analyses were total ash determinations of the whole plants and the expressed juice. A survey of the data (unpublished) obtained over a period of several years on the Atlas (resistant) and dwarf Yellow Milo (susceptible) varieties shows marked differences in the ash content, Milo always having the greater percentage, although at times the difference has been small. This difference in ash content suggested that there might be a difference in the specific conductivities of the juices which could be correlated with insect resistance.

Martin et al. (1931) determined the specific conductivities of juices from the leaves and internodes of various sorghums and secured varying results; at times considerable varietal differences were found and at others very little if any. These results made it seem worth while to find the conductivities of the juices from several varieties.

EXPERIMENTAL

The grain sorghum plants were grown in standard width rows on a sandy loam and samples were secured for analysis at the same time from plants of the same age. Such sampling does not take into consideration variations in degree of maturity due to differences in growth habits. Chinch bug injury or resistance, however, is normally most pronounced in less mature plants (from sprouting until just short of heading) and for this period it is felt that the results are quite comparable.

Plants were cut at the surface of the ground, immediately brought into the laboratory and frozen with solid CO_2. Later the samples were ground and the juice expressed by means of a Carver laboratory press. (The data in Table I were secured on juice prepared from the fresh plants without freezing.) Before any juice was used for analysis it was centrifuged for 10 minutes to remove suspended material.

Ash values were secured by incinerating the samples at low red heat until a practically carbon-free sample was secured.

Specific Conductivity measurements were made by use of the conventional Wheatstone bridge apparatus with a microphone hummer-earphone detector system. The constant of the fixed electrode dip cell was established by calibration with a standard KCl solution (Gortner 1938: 328-9).

Data in table I compare the ash and conductivity values of the juices from two varieties that have been most used in our work to date. As mentioned previously, Atlas sorgo is relatively resistant to injury and Dwarf Yellow Milo very susceptible. In this table the ash percentages for the two varieties are rather closer together than in most of our other data, but the Milo percentages are always somewhat higher and at times considerably so. An examination of the conductivity data leads to only one conclusion: that for these two varieties, at least, there is no correlation between resistance to chinch bug injury and conductivity of the juice.

The data in table II show the conductivities of juices of a heterogeneous group of sorghums, ranging in insect resistance from those most resistant (at the top of the table) to some that are 100 percent destroyed by severe infestations (Snelling et al. 1937). These plants ranged in height from about 8 inches at the first sampling time to 30 to 37 inches at the last time. Older plants were not sampled, since the most serious injury is suffered before the plants have begun to head. An examination of the table shows that there are appreciable differences between results for certain varieties, as extreme as 50 percent at the first sampling date. These differences have largely disappeared at the time of the second sampling, however, and, as in the previous table, changes henceforth in any one variety are small. Juices from nearly all varieties show small decreases in conductivity as the plants age without, however, any significant variation as regards their resistance.

TABLE I

Analyses of the press juice from whole sorghum plants at different stages of growth (1937)[1]

Age[2]	Average height	Ash	Specific conductivity
		Atlas (Resistant)	
days	*in.*	%	*mhos*
24	6	1.05	.0092
30	8	1.19	.0091
34	9	1.10	.0135
42	17	1.12	.0136
48	22	1.15	.0131
57	28	1.16	.0136
63	33	1.02	.0138
77	39	1.13	.0170
	Dwarf Yellow Milo (Susceptible)		
24	7	1.10	.0093
30	7	1.24	.0092
34	10	1.19	.0094
42	15	1.21	.0137
48	18	1.24	.0136
57	22	1.30	.0138
63	25	1.21	.0138
77	28	1.66	.0210

[1]Samples harvested at 7:00-7:30 a. m.
[2]Days from planting (first sampling, June 4).

TABLE II

Specific conductivity[1] of the press juice from sorghums of varying resistance to chinch bug injury at different stages of growth.

Variety[2]	33[3]	41[3]	48[3]	55[3]	63[3]	Ave.
Atlas	.0130	.0127	.0116	.0125	.0110	.0122
Reed kafir	.0134	.0134	.0129	.0147	.0127	.0134
Kansas orange	.0162	.0119	.0124	.0149	.0121	.0135
Kansas orange x dwarf yellow milo	.0136	.0129	.0131	.0141	.0109	.0129
Darso	.0138	.0129	.0120	.0133	.0123	.0129
Blackhull kafir	.0147	.0147	—	.0147	.0136	.0144
Club	.0144	.0152	.0139	.0134	.0114	.0137
Chiltex	.0132	.0139	.0154	.0138	.0119	.0136
Quadroon	.0144	.0141	.0159	.0150	.0150	.0149
Club x Day milo	.0125	.0134	.0139	.0136	.0127	.0132
Wheatland	.0163	.0144	.0138	.0153	.0139	.0147
Day milo	.0137	.0138	.0147	.0144	.0129	.0139
Feterita	.0107	.0115	.0110	.0121	—	.0113
Finney milo	.0138	.0146	.0128	.0144	.0127	.0137

[1]In mhos
[2]Most resistant variety at the top, least resistant at the bottom.
[3]Days from planting (1941). Samples taken at 4:30 p. m.

SUMMARY AND CONCLUSION

There is little if any significant change in specific conductivities of the juices from various sorghum varieties after the earlier stages of growth. Such differences as are shown fail to correlate with the observed differences in resistance to chinch bug injury. Similarity of varietal results also indicates that specific conductivity is probably not a factor in explaining varietal differences in chinch bug resistance.

LITERATURE CITED

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