quality of the diet than it does on total calorie intake.

3. Adequate calorie production per person can be maintained on much less productive area than is done at present in certain world areas. Thus, the population can increase from a food supply standpoint but this will necessitate a shift in the diet. Table 3 indicates that a shift in the basic diet of the average North American from what we now enjoy to that of the average Oriental would allow roughly nine times our present population in the United States or about 1.8 billion people providing this population increase did not decrease our basic producing land area or, in other words, the United States could feed one-half the present world population a subsistence diet with present production. An adequate diet quality can be maintained if items of high production efficiency such as milk or soybeans are used as a primary protein supply.

4. Luxury foods are produced to utilize excess caloric production in calorie rich areas of the world such as the United States. The United States is the only country in the history of the world that has had enough basic productivity to divert major amounts of cereal grains to fatten livestock in sufficient quantity to provide substantial levels for consumption by the common working class of people.

5. Developing areas of the world need to place emphasis on the production of efficient converters of sunlight to calories that are consumable by man.

References

1. Nutritive Value of Foods. USDA Home & Garden Bulletin No. 72, U.S. Government Printing Office, Washington, D.C. 1964
2. McVickar, M. H., Fertilizer Technology and Usage, Page 2. Soil Science, Soc. Am., Madison 11, Wisconsin 1963

Table 1. Comparative Productive Capability of Agricultural Crops [1]

POTATOES

$$\frac{\text{Cal.}}{\text{A}} = 450 \text{ bags/A} \times 100 \text{ lb/bag} \times 3 \text{ potatoes/lb} \times 90 \text{ cal/potato} = 1.2 \times 10^{7} \text{ cal/A}$$

RICE

$$\frac{\text{Cal.}}{\text{A}} = \frac{185 \text{ cal.}}{168 \text{ gm cooked}} \times \frac{3 \text{ gm cooked}}{1 \text{ gm dry}} \times \frac{454 \text{ gm}}{\text{lb}} \times \frac{3500 \text{ lb}}{\text{A}} = 5.25 \times 10^{6} \text{ cal/A}$$

SWEET CORN

$$\frac{\text{Cal.}}{\text{A}} = \frac{70 \text{ cal.}}{\text{ear}} \times \frac{1.5 \text{ ear}}{\text{stalk}} \times \frac{25{,}000 \text{ stalks}}{\text{A}} = 2.63 \times 10^{6} \text{ cal/A}$$

CABBAGE

$$\frac{\text{Cal.}}{\text{A}} = \frac{35 \text{ cal.}}{100 \text{ gm raw}} \times \frac{454 \text{ gm}}{\text{lb}} \times \frac{40{,}000 \text{ lb}}{\text{A}} = 6.4 \times 10^{6} \text{ cal/A}$$

SUGAR BEETS

$$\frac{\text{Cal.}}{\text{A}} = \frac{770 \text{ cal.}}{200 \text{ gm sugar}} \times \frac{0.14 \text{ gm sugar}}{1 \text{ gm beets}} \times \frac{454 \text{ gm beets}}{\text{lb}} \times \frac{2000 \text{ lb}}{\text{T}} \times \frac{17\text{T}}{\text{A}} = 8.4 \times 10^{6}$$

MILK PRODUCED FROM CORN SILAGE

$$\frac{\text{Cal.}}{\text{A}} = \frac{160 \text{ cal. } 3.5\% \text{ milk}}{\text{cup}} \times \frac{16 \text{ cup}}{\text{gal.}} \times \frac{6 \text{ gal.}}{\text{cow} \times \text{day}} \times \frac{\text{cow} \times \text{day}}{25 \text{ lb TDN}} \times \frac{.21 \text{ lb. TDN}}{\text{lb. corn silage}} \times \frac{2000 \text{ lb corn silage}}{\text{T}} \times \frac{20\text{T}}{\text{A}} = 5.17 \times 10^{6}$$

BEEF PRODUCED FROM CORN SILAGE

$$\frac{\text{Cal.}}{\text{A}} = \frac{250 \text{ cal.}}{85 \text{ gm}} \times \frac{454 \text{ gm}}{\text{lb}} \times \frac{0.5 \text{ lb meat}}{\text{lb carcass}} \times \frac{620 \text{ lb carcass}}{1000 \text{ lb steer}} \times \frac{\text{lb steer}}{8.3 \text{ lb TDN}} \times \frac{0.21 \text{ lb TDN}}{\text{lb corn silage}} \times \frac{2000 \text{ lb corn silage}}{\text{T}} \times \frac{20 \text{ T}}{\text{A}} = 4.16 \times 10^{5} \text{ cal/A}$$

Table 2. Calorie intake by peoples of Far East and North America

	Calories/ Capita/ Day	Calories/ Capita/ Year	Total protein g/capita/day	Animal protein g/capita/day
Far East	2070	7.62×10^{5}	56	8
North America	3120	1.14×10^{6}	93	66

Table 3. Productive Area Requirement Per Person

Diet Component	% Composition	Yearly Consumption/person	Calorie production/A	Acres required per person
Oriental 7.6×10^{5} calories/year				
Rice	50	3.8×10^{5} cal.	5.2×10^{6}	.073
Cabbage	30	2.3×10^{5} cal.	6.4×10^{6}	.036
Milk	20	1.5×10^{5} cal.	5.2×10^{6}	.029
				.138A
North American 1.14×10^{6} calories/year				
Beef	40	4.5×10^{5} cal.	4.2×10^{5}	1.07
Potatoes	30	3.4×10^{5} cal.	1.2×10^{7}	.03
Sweet Corn	30	3.4×10^{5} cal.	2.6×10^{6}	.13
				1.23A

MUTANTS OF MAIZE TEACHING EXAMPLES[1]

V. E. Youngman, D. E. Green, and L. H. Smith [2]

The maize plant (Zea mays L.) is of American origin and an important food, feed, and industrial crop. Many fundamental principles of genetics have been established or substantiated with maize. While some of these characters are useful only as genetic markers, other mutants form the basis for improvement of the crop. Examples of useful mutants include the endosperm mutant for high lysine content, the cytoplasmic male-sterility and restorer system for hybrid seed production, and the high amylose and waxy mutants forming the basis of new industrial products from maize starch.

Neuffer, Jones, and Zuber (1968) authored the book Mutants of Maize,[3] in which pictures of the mutants were shown in color for various seed and plant characters. The purpose of this paper is to point out the possible use of selected mutants as well as the book in the classroom and/or laboratory of courses in the biological sciences.

The following mutants are suggested to demonstrate selected genetic principles.[4] Each character is listed with descriptive name, gene symbol, numerical order of gene position on the linkage map beginning with the end of the short arm of each chromosome, and chromosome location. For example, the glossy gene is located 36 units from the end of the short arm on Chromosome 7.

1. 3:1 ratio
   A. GLOSSY - gl_1 - 36 - Chromosome 7.
   B. VESTIGIAL GLUMES - Vg - 85 - Chromosome 1.
   C. SUGARY ENDOSPERM - su_1 - 71 - Chrosome 4.
2. 9:3:3:1 ratio
   ANTHOCYANINLESS - a_1 - 111 - Chromosome 3, and
   , SHRUNKEN ENDOSPERM - sh_1 - 29 - Chromosome 9.
3. 9:7 ratio
   ANTHOCYANINLESS - a_1 - 111 - Chromosome 3,
   ALEURONE COLOR - C - 26 - Chromosome 9, and
   ALEURONE AND PLANT COLOR - R^r - 57 - Chromosome 10.
4. Linkage
   SHRUNKEN - sh_2 - 111.2 - Chromosome 3. and
   AUTHOCYANINLESS - a_1 - 111 - Chromosome 3.
5. Xenia
   YELLOW ENDOSPERM - Y_1 - 17 - Chromosome 6.
6. Dosage effect
   A. COLORED ALEURONE - R_2 - 49 - Chromosome 2.
   B. COLORLESS ALEURONE - c_2 - 123 - Chromosome 4.
7. Pericarp effect
   PERICARP AND COB COLOR - P - 26 - Chromosome 1.

Summary

Maize mutants which may be useful in demonstrating certain genetic principles are suggested.

Literature Cited

Neuffer, M. G., Loring Jones, and Marcus S. Zuber. 1968. Mutants of Maize. Crop Science Society of America, Madison, Wisconsin. 74 pp.

1 Published with the approval of the Director of the Colorado State University Experiment Station as Scientific Series Paper No. 1659.

2 Associate Professor, Department of Agronomy, Colorado State University; Professor, Department of Agronomy, Iowa State University; and Professor, Department of Agronomy and Plant Genetics, University of Minnesota, respectively.

3 The book, Mutants of Maize, is available from the Crop Science Society of America, 677 S. Segoe Road, Madison, Wisconsin, 53711.

4 Germ plasm quantities of seed of these mutants are available from Dr. R. J. Lambert, Department of Agronomy, University of Illinois, Urbana, Illinois, 61803. The necessary stocks to maintain the mutant will also be provided. If one does not wish to grow his own plant materials, ears may be purchased from any of several leading biological supply houses.