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## in this issue:

THE YEAR-ROUND NUTRITIVE VALUE  
OF PERMANENT PASTURE

PLANTING METHODS FOR SWEETGUM

FEEDING TESTS WITH DAIRY HEIFERS

## LOUISIANA AGRICULTURE

AGRICULTURAL EXPERIMENT STATION  
LOUISIANA STATE UNIVERSITY  
AND AGRICULTURAL AND MECHANICAL COLLEGE

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Director, Agricultural Experiment Station

## COVER PICTURE



Specimens of a new sweet potato just released by the Experiment Station are shown in the cover picture with two members of the team that developed the new variety: Dr. Travis P. Hernandez (left), superintendent of the Sweet Potato Research Center at Chase, and Dr. Teme P. Hernandez, horticulturist and project leader in sweet potato breeding at Baton Rouge. Working with the Hernandez brothers on the new variety were Dr. Roysell J. Constantin, horticulturist, and Dr. Weston J. Martin, plant pathologist. A major attribute of the new variety, named Jasper, is its resistance to soil rot. Details are given in the article beginning on Page 3.

# JASPER: A new sweet potato variety

TEME P. HERNANDEZ, TRAVIS P. HERNANDEZ,  
ROYSELL J. CONSTANTIN and WESTON J. MARTIN<sup>1</sup>

**T**HE FIRST soil rot resistant sweet potato variety adapted for production in Louisiana was released by the Louisiana Agricultural Experiment Station this year. The new variety, named Jasper, was formerly known as seedling L9-190.

Jasper produces well shaped roots with a bright copper skin color and orange flesh. It is highly resistant to soil rot, a very destructive disease in some commercial areas of Louisiana. It also has good resistance to internal cork and stem rot (fusarium wilt) and moderate resistance to root-knot nematodes.

This variety resulted from several years of sweet potato breeding. In 1969, approximately 90,000 sweet potato true seed were scarified and planted in greenhouse beds in January at the Sweet Potato Research Center in Chase, La.

The seedlings were allowed to grow until May of that year when each seedling had produced a small fleshy root 1 inch or more in diameter. The seedlings were harvested and evaluated for horticultural characters and some 10,000 were selected and transplanted into the field.

In September 1969, each seedling was harvested and 437 individual seedlings, including L9-190, were selected on the basis of yield, skin and flesh color, and storage ability. Seed

roots from these were saved for the subsequent crop.

In 1970, selected seedlings, including L9-190, were grown in 30-foot plots on each of three planting and harvesting dates. Jasper (L9-190) was reselected as an outstanding seedling in 1970 and placed in replicated trials in 1971, 1972, and 1973. It was grown 3 years in advanced replicated tests in comparison with Cen-



In quality studies by Dr. Roysell J. Constantin, Jasper ranked a little better for canning or baking than the major variety now being produced. Most Louisiana yams are processed, with about one-fourth going to the fresh market.

also tested in cooperation with members of the National Sweet Potato Collaborators for 2 years. Most of the experiment stations in the southern states and the USDA's Southeastern Vegetable Breeding Laboratory in Charleston participated in the regional tests.

Members of the National Sweet Potato Collaborators, at their annual meeting in the spring of 1974, recommended that L9-190 be released as a named variety. The name Jasper was selected in honor of the late Dr. John Jasper Mikell, who served as associate director of the Louisiana Experiment Station. Dr. Mikell was administrative advisor to the National Sweet Potato Collaborators for several years, and for a number of years was active in the sweet potato breeding project at LSU.

## Varietal Description

The vines or stems of Jasper are trailing, medium in thickness, and generally 4 to 5 feet long. Vines, (Continued on Page 16)



Dr. Weston J. Martin compares disease-resistant Jasper, at right, with susceptible varieties which show ravages of soil rot. All were grown in fields infested with the fungus-caused disease.

<sup>1</sup>Professor of Horticulture, LSU, Baton Rouge; Superintendent, Sweet Potato Research Center, Chase; Associate Professor of Horticulture, LSU, Baton Rouge, and Professor of Plant Pathology, LSU, Baton Rouge, respectively.

# Year-round nutritive value of permanent pasture

D. F. COOMBS<sup>1</sup>, L. I. SMART<sup>2</sup>,  
J. M. PERKINS<sup>2</sup> and F. G. HEMBRY<sup>2</sup>

INCREASES in grain costs have tended to reemphasize the importance of pastures and their proper utilization in beef production. The South is ideally suited for the growing of pastures. However, the quality of the forage produced can differ significantly with the season of the year and the type of forage grown.

One beef forage program in Louisiana consists of bermudagrass and dallisgrass in the summer, wheat or ryegrass in the winter, and clover in the spring. Little work has been done, however, to evaluate these forages throughout the year.

With this in mind, a study was initiated at the Purebred Unit at LSU in Baton Rouge to determine nutrient content and digestibility of permanent pastures consisting of common bermudagrass, dallisgrass, and Nolin's improved white clover.

One part of the study involved using three grade Hereford steers in what is commonly called a digestion trial.

The steers were confined 7 days and fed measured amounts of grass cut from a typical pasture where cattle were grazing heaviest at that time of year. A tractor mower was used to clip the grass at about the same height at which it was being grazed. Low quality forage that was not being consumed by the cattle was removed from the clippings by hand before the grass was fed to the steers.

The permanent pasture used in this study consisted mostly of common

bermudagrass and dallisgrass during the summer. In early spring, Nolin's improved white clover, a variety of other clovers, and wild barley were the predominant forages.

## TDN Calculated

All feces and urine were collected from the steers in the digestion trial and samples were used for chemical analyses. Digestion coefficients were determined for crude protein, ether extract, crude fiber, ash, and nitrogen-free extract. Results of the digestion trial are shown in Table 1. The total digestible nutrients (TDN), a measure of energy, were calculated from these figures.

The digestible protein requirement for a pregnant cow, in relation to the digestible protein furnished by native pasture, is shown in Figure 1. In Figure 2 the digestible protein requirement for a cow nursing a calf is shown in comparison with the digestible protein furnished by native pasture.

Data in Figures 1 and 2 were calculated assuming a pregnant cow would

consume 16 pounds of dry matter per day and that a cow nursing a calf would consume 24 pounds of dry matter per day. These values could vary due to selective grazing by the cows, greater or lesser consumption of forage, and year-to-year variations.

These data should, however, give a good indication as to when supplements are needed and the amounts required. A pregnant cow may meet most of her needs by consuming more forage and selecting the higher quality forage, but a cow nursing a calf will need additional protein. The amount of cottonseed meal required is indicated in Figure 2.

The TDN (energy) requirement for a pregnant cow and the amount furnished by permanent pasture are shown in Figure 3, and the required TDN for a cow nursing a calf and the amount furnished by permanent pasture are shown in Figure 4.

## Requirements May Vary

These data were calculated from the digestion trial by using National Re-

TABLE 1.—Effect of month on digestibility of permanent pasture

Month	Dry matter	Protein	Fat	Fiber	Ash	Nitrogen-free extract
Percent digestible						
Jan.	46.1	38.6	51.7	55.5	21.3	45.8
Feb.	44.4	33.1	49.8	49.3	17.1	49.9
Mar.	39.2	46.5	79.4	36.3	35.1	42.8
Apr.	68.5	68.5	50.9	69.8	48.7	72.1
May	49.8	47.4	47.8	41.0	24.6	57.2
June	54.5	48.6	59.7	57.5	20.2	58.9
July	55.1	52.3	58.4	62.1	18.4	59.3
Aug.	50.2	45.2	48.4	56.8	25.9	54.0
Sept.	44.6	35.2	45.3	55.1	16.1	43.9
Oct.	43.9	30.5	51.9	54.5	22.0	41.9
Nov.	53.2	39.9	58.1	51.5	24.6	59.9
Dec.	46.6	33.1	51.6	55.0	20.7	48.0

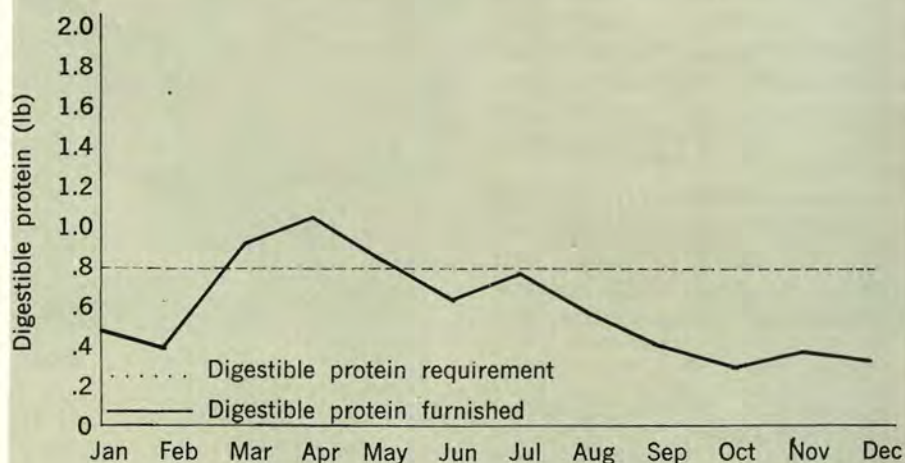


Figure 1.—Digestible protein requirement for wintering 1,000-pound pregnant cow and digestible protein furnished by permanent pasture.

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<sup>2</sup>Department of Animal Science, LSU, Baton Rouge, La.

search Council (NRC) values of 16 and 24 pounds of dry matter required per day for a pregnant cow and for a cow nursing a calf, respectively. They are subject to the same variations as the requirements for protein. The NRC requirements are average values for a 1,000-pound cow. The cattle used in this study weighed more than 1,000 pounds, making the estimates lower than they should have been.

From data presented in Figures 1, 2, 3, and 4 it is apparent that clover growing during March, April, and May has a high nutritive value and bermudagrass and dallisgrass are important during several months, particularly June and July. The quality of permanent pasture begins to drop in August or September and remains low, except for variations caused by growth of winter forage.

After the digestion trial had been conducted for a year, 66 pregnant Hereford and Angus cows were divided into two groups according to their season of calving—spring or fall.

These cows were allotted to one of three treatments: (1) permanent pasture plus grain supplement; (2) permanent pasture plus 2 pounds of cottonseed meal per head daily from December 1 to April 1, and (3) permanent pasture as much of the year as possible plus supplemental pasture when permanent pasture was inadequate.

Results of the digestion trial were used to determine when to provide supplemental grain and how much to provide.

All of the cows were weighed at the beginning of the treatments and at 56-day intervals. Weight changes in cows, weaning weights of calves, and reproductive performance of the cattle were used to measure cow productivity.

#### Weaning Weights

Weaning weights averaged 439 pounds for calves from cows on temporary pasture, 367 pounds for calves from cows in the grain supplemented group, and 350 pounds for calves whose dams received only native pasture and cottonseed meal. Differences between all three weights were highly significant ( $P < .01$ ).

Results of this study indicated, as have the results of many other studies, that different management schemes

(Continued on Page 7)

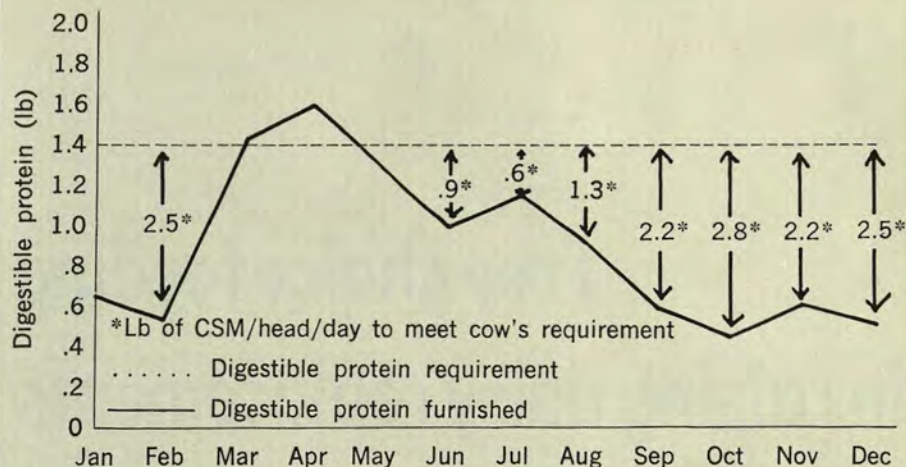


Figure 2.—Digestible protein requirement for 1,000-pound cow nursing a calf and digestible protein by permanent pasture.

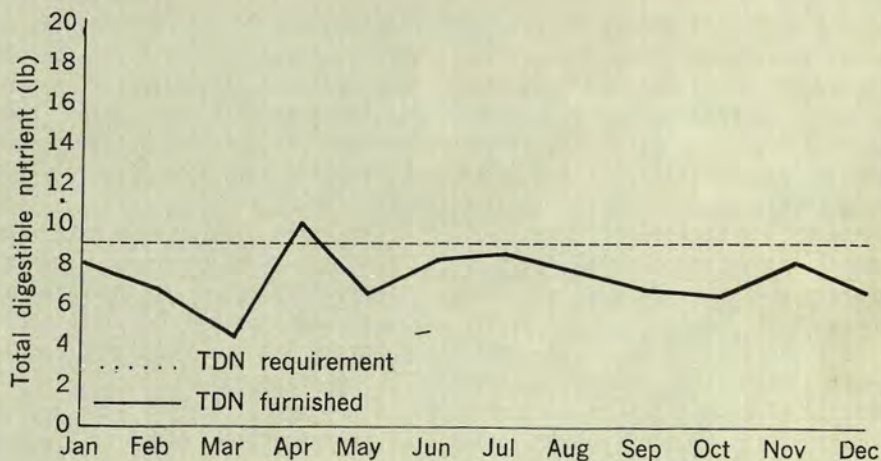


Figure 3.—Total digestible nutrient requirement for wintering a 1,000-pound pregnant cow and total digestible nutrients furnished by permanent pasture.

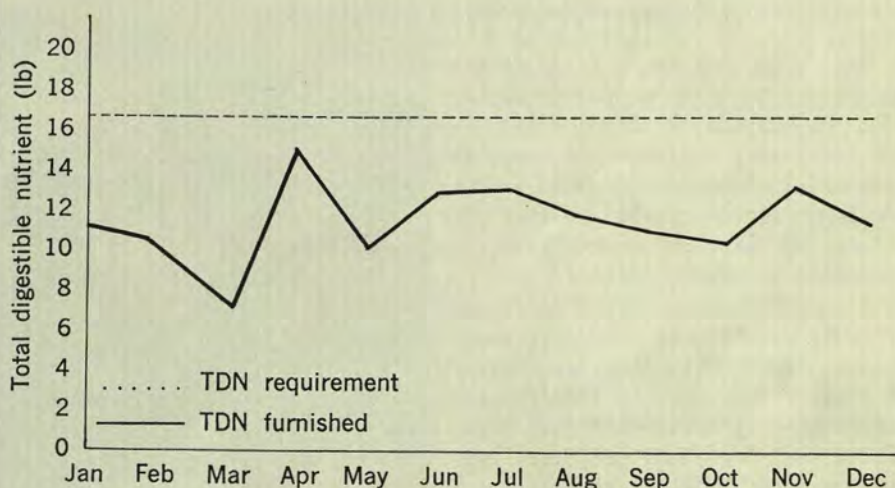


Figure 4.—Total digestible nutrient requirement for 1,000-pound cow nursing a calf and total digestible nutrients furnished by permanent pasture.

# Free choice feeding in raising dairy replacements

ARTHUR V. DAVIS and RALPH S. WOODWARD  
*North Louisiana Experiment Station, Calhoun*

**T**HE ACCEPTED system for feeding dairy herd replacements from weaning until breeding age has traditionally involved offering roughage and limited grain at least once daily. This system requires considerable time and labor. In addition, under this system slow eaters get less feed, and if there is not enough trough space, timid heifers do not get their fair share of the daily offering.

In recent years, with an eye particularly on labor saving, interest has been directed to feeding heifers a blend or mixture of a grain and roughage ration free choice. This system of feeding has several advantages over the older system. Considerable time and labor can be saved, bossy heifers are not a problem, less feeder space is needed, and grouping heifers by age and size is less critical.

With these advantages in mind research was begun at the North Louisiana Experiment Station in August 1969 to study the effect of using a self-feeding system and a blended grain-roughage ration in the growing of Jersey and Guernsey heifers from 3 months to 14 months of age.

All heifers used in this study were from the station dairy herd. They were kept in the nursery until weaned at 6 weeks of age and were then moved to the growing barn, where they were placed in individual pens and fed grain and hay while they were adjusting from the liquid diet. At about 95 days of age they were placed on the feeding management trial. Three treatments were used in this study.

Treatment 1 heifers served as the control group and were fed the conventional way. They were fed Coastal bermudagrass hay free choice, using conventional hay feeding facilities and 4 pounds of a 16 percent protein dairy ration daily.

Treatment 2 heifers were fed a blend, 40 percent of which was a 16 percent protein dairy ration and the remaining 60 percent, Coastal bermuda pellets. A gravity flow self-feeder was used. No hay was fed to this group.

Treatment 3 heifers were fed the 16 percent protein ration at 4 pounds per day and were fed Coastal bermudagrass pellets free choice in a self-feeder as the source of roughage.

Pasture was available to all groups

at all times. Coastal bermudagrass pellets were used in the trial because they were readily available and in good supply. Other roughages or mill by-products may be used in a feeding system of this type.

Twenty-eight heifers were used in each of the groups, with 11 Jerseys and 17 Guernseys in Groups 1 and 2 and 10 Jerseys and 18 Guernseys in Group 3. These heifers were assigned alternately to one of the three treatments, as they became 3 months of age, from August 1969 through September 1972; thus four complete seasons passed during the duration of this study. Body weight and wither height measurements were taken at monthly intervals, and heifers were removed from the test at 14 months of age.

## Summary of Findings

A summary of the results of this study is shown in Table 1. The data showed no differences between the two breeds in the effects of the treatments. Therefore the summary was made without respect to the different breeds. However, since 14 months of age is considered breeding age, the weights of the Jersey and Guernsey heifers are shown to indicate their relative development for breeding. Jerseys in Groups 1, 2, and 3 weighed 586 pounds, 585 pounds, and 604 pounds, respectively. Guernseys in the same groups weighed 638, 688, and 676 pounds, respectively.

The final weights of both breeds indicate adequate development of the



Considerable labor is saved when replacement heifers are fed a blended grain-roughage ration in a self-feeder.

heifers. No statistical differences were shown in final weights among the three groups. The weight gains were somewhat less for Group 1 (483 pounds), although satisfactory, than for Groups 2 and 3 (511 pounds for each group).

The pasture program during this study was considered to be good, with excellent to good forage available most of the time. This may help to explain the lack of differences in the performances of the three groups.

The amount of grain consumed by calves in Group 2 (3.55 pounds), which had the blended ration, was a little less than for Groups 1 and 3, which were fed a controlled 4 pounds per day. Consumption of Coastal bermudagrass pellets was also about the same for Group 2 calves (1,787 pounds), which had the blended ration, and Group 3 calves (1,719 pounds), which were fed the pellets in a self-feeder and fed grain separately. This tends to prove the desirability of the 40 percent grain—60 percent roughage blend.

Calves in Group 1, which received Coastal bermudagrass hay (490 pounds), consumed very little hay during the periods of excellent to good pasture. Thus the total amount of feed intake was considerably higher for Groups 2 and 3.

All heifers grew in stature at about the same rate with little or no difference in wither height gains at the end of the trial. Heifers in Group 1 gained

TABLE 1.—Summary of free choice heifer feeding study, 1969-73

Item	Group 1	Group 2	Group 3
Number of calves on test	28	28	28
Starting weight, pounds	135	137	140
Final weight, pounds	618	648	651
Jersey	586	585	604
Guernsey	638	688	676
Pounds of weight gain	483	511	511
Number days on test	339	335	336
Pounds of gain per day	1.42	1.52	1.52
Wither height gains, inches	14.48	14.24	14.48
Pounds of grain consumed per calf	1355	1191	1343
Pounds of CB hay consumed per calf	490	—	—
Pounds of CB pellets consumed per calf	—	1787	1719
Total pounds of feed consumed per calf	1845	2978	3062
Total pounds of feed per calf per day	5.44	8.89	9.12
Cost of grain per calf <sup>1</sup>	\$44.77	\$39.32	\$44.32
Cost of CB pellets per calf <sup>2</sup>	—	\$46.47	\$44.70
Cost of CB hay per calf <sup>3</sup>	\$7.36	—	—
Total feed cost per calf	\$52.13	\$85.79	\$89.02
Pounds of feed fed per pound of gain	3.64	5.83	5.99
Number of services per conception	2.37	1.89	1.84

<sup>1</sup>\$66 per ton.

<sup>2</sup>\$52 per ton.

<sup>3</sup>\$30 per ton.

14.48 inches, those in Group 2, 14.24 inches, and those in Group 3, 14.48 inches.

The cost for each of these groups may be irrelevant, because in actual commercial operations there may be variations in feed and hay costs and in the expertness of management in utilizing its resources. However, this feature is added to the summary for completeness. Each source of management may come up with a totally different set of costs. The amount of labor used to properly raise replacements is important, and by using a

blended ration in a self-feeder, considerable savings of labor can be made.

Breeding efficiency is important to a dairy herd. The breeding records of these heifers show that heifers in Groups 1, 2, and 3 required 2.37, 1.89, and 1.84 services per conception, respectively. One heifer from Group 1 was declared a non-breeder after 7 services, and 3 heifers in Group 3 were non-breeders after 5, 6, and 7 services each. Many factors are involved in breeding efficiency, and the effect of treatment during this study did not seem to influence this efficiency.

## Year-round nutritive value of permanent pasture

(Continued from Page 5)

are needed for fall-calving and spring-calving cows.

Over-all, spring calves had the heaviest weaning weights, averaging 407 pounds as compared with 363 pounds for fall calves. However, fall calves from cows on temporary pasture (browntop millet, then wheat and ryegrass) had the highest average weaning weight of 440 pounds. The lowest average weaning weight was 298 pounds for fall calves from cows that received cottonseed meal while on permanent pasture.

Average weaning weights of 401 pounds for spring calves from cows on permanent pasture plus cottonseed meal, 382 pounds for spring calves from cows

receiving grain supplement, and 352 pounds for fall calves from cows receiving grain supplement were all below the weaning weights of calves from cows that received supplemental temporary pasture when permanent pasture was inadequate.

A significant seasonal difference was found in the conception rates of cows ( $P < .05$ ). Mean conception rates were 86.7 percent for fall-calving cows and 62.5 percent for spring-calving cows.

A highly significant difference was found in cow weights among the different groups ( $P < .01$ ). Mean weights were 1,108 pounds for the group on permanent and supplemental pastures, 1,030 pounds for the group on permanent

pasture with grain supplement, and 1,020 pounds for the group on permanent pasture with cottonseed meal.

Time of calving and breed were found to have significant effects on cow weights also ( $P < .05$ ). This mean weight for fall-calving cows was 1,066 pounds as compared with 1,039 pounds for spring-calving cows. Angus cows weighed 1,040 pounds, as compared with 1,065 pounds for Hereford cows.

Considering both reproduction and weaning weights, the greatest total production in this study came from the fall-calving cows that were placed on temporary pasture during periods when the permanent pasture was deficient.

# Oxygen deficiency in poorly drained alluvial soils used for cotton

W. H. PATRICK, JR.  
and R. D. DELAUNE  
*Department of Agronomy*

MANY of the low-lying alluvial soils in the cotton areas of Louisiana contain high amounts of most plant nutrients but are limited in their productivity because of unfavorable physical conditions. Cotton does poorly on these soils during wet seasons.

Agronomists have assumed that the low yields are caused by excessive moisture in the relatively impervious soil profile which limits soil aeration (soil oxygen supply). It is generally accepted that an adequate supply of soil oxygen at all depths in the root zone is necessary for effective root development. Even temporary periods of oxygen deficiency cause damage to the root system and decrease the yield.

Although a low oxygen content had been suggested as the major cause of low yields on poorly drained alluvial soils, until recently no studies had shown the actual oxygen status of these soils and the relationship of oxygen content to root growth and development. This information was not available largely because of the difficulty of adequately measuring the oxygen content of soil air under field conditions.

## Oxygen Patterns Studied

A simple and effective method for measuring soil oxygen recently became available and has been used to study oxygen patterns in several soils used for cotton in the Northeast Louisiana Recent alluvial area. In this study, the oxygen content of the soil air was measured at several depths throughout the growing season.

In addition to poorly drained soils where oxygen deficiency was suspected, adjacent better drained alluvial soils were also included so that the aeration status could be compared. The study was carried out in two experimental areas for a 2-year period.

Typical results for oxygen profile analyses are shown in Figure 1 for the well drained Bruin soil and in Figure 2 for the adjacent poorly drained Mhoon soil at the Northeast Louisiana Experiment Station.

Oxygen content at all depths was high throughout the growing season in Bruin soil, indicating no restriction on root growth due to poor soil aeration.

The situation was different for the poorly drained Mhoon soil, however, with a deficiency of oxygen being evident in the subsoil during the first

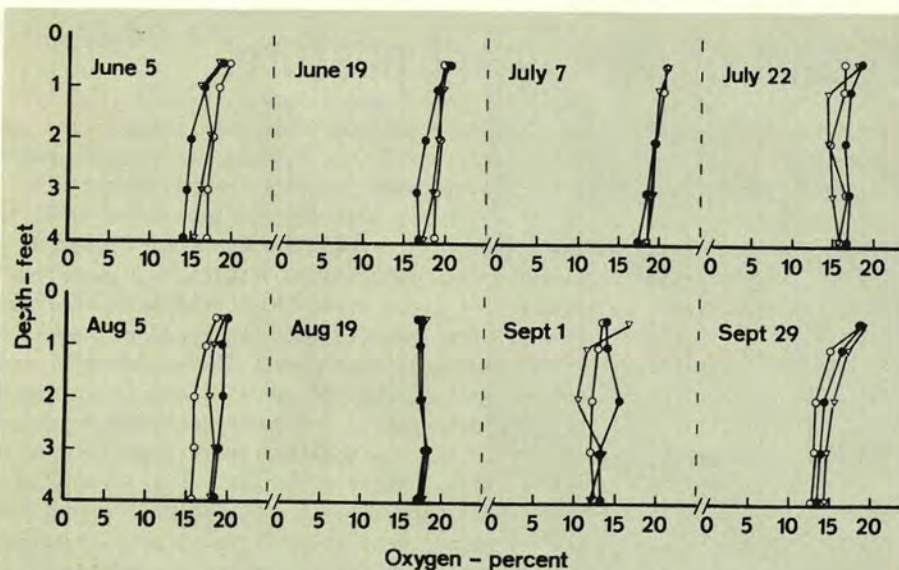


Fig. 1.—Oxygen distribution in Bruin soil at three adjacent sites at the Northeast Louisiana Experiment Station in 1970.

part of the growing season. As the season progressed and the soil dried enough to allow more oxygen to penetrate from the atmosphere the subsoil oxygen content of the air increased to 15 percent or higher, which is considered to be an adequate level for good root growth.

Excessive rainfall on a relatively impervious soil, such as the Mhoon, however, can seal the surface layer and temporarily prevent oxygen from entering the soil, with resulting injury to the root system. Such a condition is shown by the September 1 oxygen profile (Fig. 2), which was measured several days after a heavy rain. Root injury during a temporary period of inadequate oxygen concentration (and corresponding buildup of carbon dioxide) will cause a heavily fruiting cotton plant to shed bolls and squares.

#### Root Development Affected

The close relationship between oxygen content and root development for all of the experimental sites used in this study in 1970 is shown in Figure 3. It was found that not only must there be adequate oxygen in the soil profile for roots to develop, but the oxygen must also be present during the first part of the growing season or roots will not develop adequately in the lower depths of the soil. Even if the oxygen content of the subsoil increases to a normal level during the last part of the growing season, few roots will develop at lower depths.

Because of the close relationship between soil oxygen content and subsoil root development found in these alluvial soils, it is likely that better plant growth and higher yields can be obtained on poorly drained soils if soil aeration is improved. Experiments are now under way to determine if plastic tile drainage will remove enough excessive subsoil moisture to enable more air to penetrate into the subsoil. Some of these poorly drained soils have high water tables during the early part of the growing season, and lowering this water table with tile drainage should increase the oxygen content in the subsoil.

Improving the physical condition of the soil by rotating cotton with soil building crops should also improve the physical condition of the soil and permit better water and air movement in the soil profile.

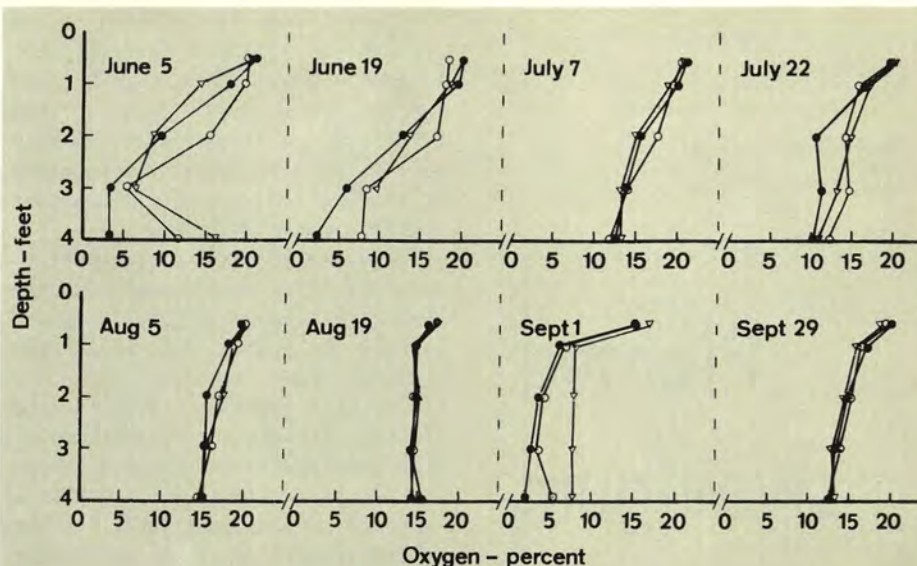


Fig. 2.—Oxygen distribution in Mhoon soil at three adjacent sites at the North-east Louisiana Experiment Station in 1970.

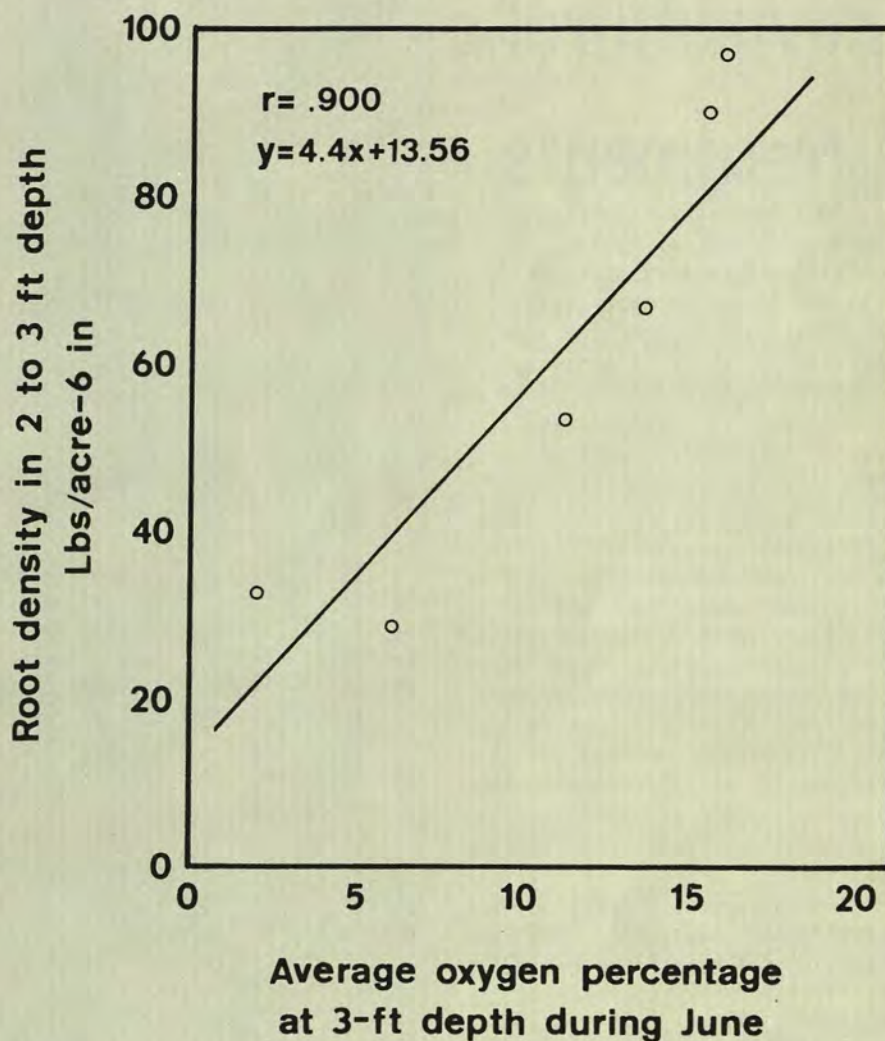


Fig. 3.—Relationship between average oxygen content at the 3-foot depth during June and amount of roots in the 2- to 3-foot depth at end of growing season in 1970.

# Planted sweetgum responds to silvicultural treatments

ANATOL KASZKUREWICZ<sup>1</sup>

*School of Forestry and  
Wildlife Management and  
Louisiana Forestry Commission*

**T**HE REGION known as the Mississippi Delta is one of the most important hardwood-producing areas in the United States. In Louisiana in 1964 Delta hardwood forests covered 4.6 million acres, containing stands of oak, gum, hickory, sycamore, cottonwood, ash, pecan, and other species used for a variety of wood products. The demand for hardwoods has been increasing rapidly, and the annual cut of hardwoods in Louisiana exceeds the growth.

The U.S. Forest Service has estimated that in Louisiana by 1983 hardwood cut will exceed the growth by

50 percent. This estimate seems to be quite realistic, especially when the rapid decrease in hardwood acreage is taken into consideration. In the 10 years 1962-1971 an estimated 1.2 million acres of hardwood forests were cleared in Louisiana, 90 percent of which were used for soybean production.

To secure the continuity of hardwood supply to meet future needs the productive capacity of those areas still available for growing hardwoods must be exploited to a maximum.

The LSU School of Forestry and Wildlife Management, in collaboration with the Louisiana Forestry Commission, has been testing various hardwood planting methods since 1960. The aim of the research has been to develop

planting techniques that will be more effective than the conventional or standard method.

Among several hardwood species included in the project, sweetgum received special attention because of its versatility for the wood industry. Also, tests of the effects of intensive cultural treatments on survival and early growth of planted sweetgum had not been made prior to this study.

Sweetgum is very tolerant of different soils. The U.S. Forest Service soil scientists listed 99 soil series in the Midsouth alone on which the species should be favored in management. They found that rich, moist silty clay and silty clay loams with moderate to good internal drainage and without a



Ten-year-old sweetgum on a medium site after application of about 13 ounces of 10-20-10 fertilizer per tree at the age of 4 years.

<sup>1</sup>The author is grateful to Dr. K. L. Koonce, Department of Experimental Statistics, and to Dr. T. D. Keister, School of Forestry and Wildlife Management, for their assistance in statistical analyses.

hardpan in the top 2 feet, are the most productive sites for sweetgum.

Early results from studies with yellow poplar, a common associate of sweetgum, showed the beneficial effect of double-furrow soil bedding on height growth. Survival and diameter growth were directly related to the root-collar diameter of seedling. Experimental work on establishing cottonwood plantations revealed that early growth depends on a proper balance between soil aeration and available soil moisture. These results led to the idea that a significant improvement in sweetgum growth could be obtained by breaking the soil hardpan and mixing various soil strata of different texture and fertility in planting holes made by a soil auger 9 inches in diameter.

#### Plantation Established

An experimental sweetgum plantation was therefore established at the Idlewild Experiment Station near Clinton, Louisiana, in spring of 1964. The experiment was conducted over a 10-year period.

During the first part of the experiment, from the day of planting through the fourth year, the effects of 36 treatment-combinations were tested. These included three mulching methods (no mulch, black polyethylene pads, bedding of the soil in a double furrow), three weeding methods (no weeding, weed-mowing, Amizine spray), and four dibble-planting methods (by the standard method in undisturbed soil, and in mixed soil in auger-prepared holes 12, 21, and 30 inches deep and 9 inches in diameter).

During the second period, from the beginning of the fifth growing season through the tenth year of growth, the effects of four levels of fertilizer were tested: none, 125 gr (about 4½ oz), 250 gr (about 9 oz), and 375 gr (about 13 oz) of 10-20-10 fertilizer applied broadcast over an area of 36 square feet around a tree.

Within the plantation, variation in site productivity was recognized. Productivity was best (good site) at the base of the slope where soil moisture conditions were good and extractable phosphorus, potassium, and calcium were higher than on the upper slope (poor site). The middle slope position was considered of medium productivity.

The 4-year tree heights were related to extractable phosphorus in the upper

TABLE 1.—Tree size and merchantable volume by site and fertilizer level in 10-year-old sweetgum plantation at the Idlewild Experiment Station near Clinton, Louisiana

Site	Fertilizer level <sup>1</sup>	Merchantable height <sup>2</sup>	Average diameter, breast height	Merchantable volume per acre	Pulpwood yield	
		Feet	Inches	Cubic feet	Cords <sup>3</sup> Ac./Yr.	Percent
Poor	1	7.97	3.58	456.6	0.56	100.0
"	2	10.08	4.26	866.0	1.06	189.9
"	3	10.61	4.08	825.0	1.01	180.9
"	4	11.74	4.17	1102.4	1.34	241.7
"	Ave.	10.28	4.04	812.5	0.99	
Medium	1	9.95	4.11	733.8	0.89	100.0
"	2	9.69	4.16	941.6	1.15	128.3
"	3	11.62	4.49	1079.2	1.32	147.1
"	4	11.65	4.49	1150.8	1.40	156.8
"	Ave.	10.75	4.31	976.4	1.19	
Good	1	10.49	4.07	882.7	1.08	100.0
"	2	11.27	4.42	1119.9	1.36	126.8
"	3	14.88	4.69	1707.4	2.08	193.4
"	4	12.75	4.52	1329.2	1.62	150.5
"	Ave.	12.48	4.43	1259.8	1.54	
Average	1	9.57	3.93	691.0	0.84	100.0
"	2	10.35	4.27	975.8	1.19	141.2
"	3	12.59	4.42	1203.9	1.47	174.2
"	4	12.06	4.39	1194.1	1.46	172.8

<sup>1</sup>Level: 1—None, 2—125 gr (about 4½ oz.), 3—250 gr (about 9 oz.), and 4—375 gr (about 13 oz.) of 10-20-10 fertilizer applied broadcast over 36 square feet area around a tree.

<sup>2</sup>Height from 3-inch-stump level to 3.5 inches diameter top outside bark.

<sup>3</sup>Cord = 82 cubic feet.

foot of soil, and this was the reason for the use of 10-20-10 fertilizer.

Ten years' data on sweetgum growth were analyzed in a linear model which considered the effects of sites, planting treatments, and fertilizer levels, as well as the random effects of seedling height, root-collar diameter, and root length, using individual trees as the observations.

#### Best Practices Shown

Ten-year survival (average for all sites) was the best (95 percent) among the trees which were planted in the soil mixed in 12-inch-deep holes, mulched with the soil bedded in double furrows, and fertilized with 250 gr of the fertilizer. The poorest survival (75 percent) was among the trees planted by the standard method, without mulch and fertilizer.

Ten-year merchantable volume per acre (Table 1) resulted from the effects of all the factors which influenced the initial survival and the 4-year growth, as modified further (during the last six years) by fertilizer levels, and an ecological factor—the increasing competition among the trees, which was strongly pronounced because of close spacings (6 x 6 feet) at which the trees were planted.

The results of the study proved that

the standard method of planting is not the best technique for establishing sweetgum plantations. The major shortcomings of this method are the use of nursery-run seedlings of varying vitality, excessive compaction of seedlings' roots with dibble planting, failure to improve internal drainage in the soil, failure to protect the surface soil from drying, and failure to control weeds.

The study showed that the production of merchantable wood in a sweetgum plantation (of given spacings) can be improved by: (1) skillful selection of the site, (2) planting of selected seedlings (with the largest possible root-collars), (3) improvement of soil conditions by mixing the soil in holes about 21 inches deep and not less than 9 inches in diameter, and (4) conservation of soil moisture and control of weed competition by bedding or mulching.

Additionally, on nutritionally poor sites a further improvement of wood production can occur through application of a fertilizer designed to correct nutritional deficiencies of the site. Using the proper rate and kind of fertilizer on poor sites may improve wood production to the level achieved on good sites without fertilizer. Use of fertilizer on the good site improved survival but did not improve tree growth.

# Water hyacinths tested for cleaning polluted water

EDWARD P. DUNIGAN,  
Z. H. SHAMSUDDIN  
and R. A. PHELAN<sup>1</sup>

ANYONE who has traveled through the southern states may have noticed large areas of water covered by a beautiful and prolific plant, the water hyacinth. Researchers have calculated that 10 of these plants, which multiply

both by rhizome and by seed production, are capable of producing in excess of 655,000 new plants in a single growing season.

Buoyant float cells and sail-like leaves allow the water hyacinth to float easily from one location to another, thereby promoting its rapid spread.

Although usually found floating free, the water hyacinth will take root in sediment if evaporation of waters leaves it stranded on a drying bottom. When the land is again flooded, an abscission zone forms across the rhizome and the plant once again floats free. Apparently it is during dry periods that the seeds, which may have survived for years in the mud, germinate and initiate new rooted water hyacinths.

It is not difficult to understand why the water hyacinth, covering entire lakes and streams, is listed among the 10 most important weeds of the world. Extended freezing weather is the only major natural deterrent to its spread in this country.

## Possible Uses Studied

For the past 3 years, studies have been conducted by the LSU Department of Agronomy in Baton Rouge to determine whether some good use

<sup>1</sup>Associate Professor and Graduate Research Assistants, respectively, Department of Agronomy.

could be derived from this prolific plant.

One possibility that has been investigated involves use of these plants to absorb nitrogen and phosphorus from waters considered eutrophic, or chemically polluted, because of high levels of N and P. Chemically polluted waters are found throughout the United States. Eutrophication is a natural process, but it also can be accelerated by the uncontrolled disposal of chemical waste products.

For the tests, plants were harvested near Sorrento, La., and transported to the greenhouse in a tub filled with water from the bayou in which they had been growing. Single plants were immediately selected and placed in pots containing 6 liters of water with 0, 50, 100, or 250 ppm of either ammonium-nitrogen, nitrate-nitrogen, or phosphate-phosphorus. Each test was replicated four times and residual N or P was determined weekly by removing a few milliliters of solution from each pot and immediately analyzing it in the laboratory.

## Nitrogen Absorption

Results of the analyses were interpreted as indicating that large amounts of ammonium-nitrogen were taken up by the water hyacinths (Figure 1). At

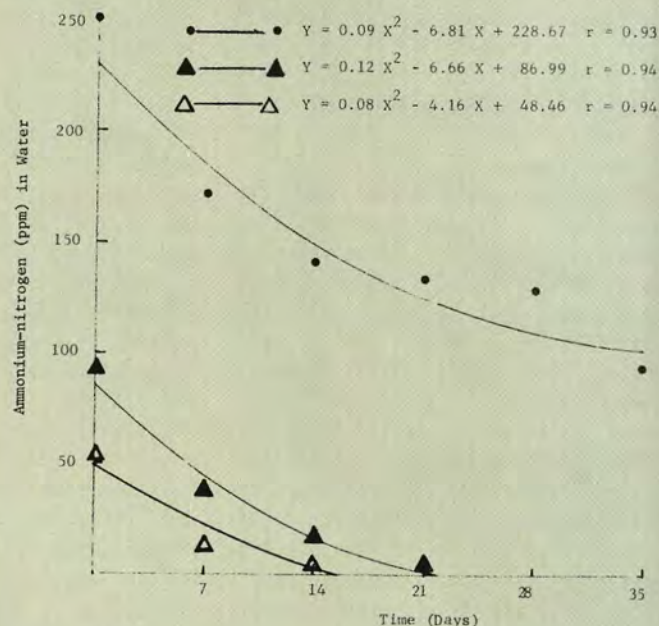


Fig. 1.—The change in aqueous concentration of 50, 100, and 250 ppm of ammonium-nitrogen as affected by the growth of water hyacinths in a greenhouse.

50 and 100 ppm, ammonium-nitrogen was completely absorbed in 15 and 20 days and over 150 ppm of the 250 ppm of ammonium-nitrogen were taken up during the 5-week test period.

Nitrate-nitrogen was also taken up in large amounts, but at a slightly slower rate (Figure 2). It required 23 days for the plants to completely absorb the nitrate-nitrogen present at 50 ppm, while 85 and 115 ppm of the two higher rates were removed within the test period.

These data might be interpreted to mean that although the water hyacinth has a preference for ammonium-nitrogen, it can still remove relatively large quantities of nitrate-nitrogen from eutrophic waters.

Other studies have indicated that water hyacinth roots are populated by a large number of microorganisms. These include denitrifying bacteria in relatively large numbers. Growth of the plants in solutions containing high concentrations of nitrate-nitrogen indicated these denitrifiers increased in number during one week. Therefore, it is possible that not all of the nitrate-nitrogen was taken up by the plant, but that some was denitrified by these root-associated bacteria. There was little evidence, however, to indicate the presence of nitrifying bacteria on

TABLE 1.—Average daily absorption rates of nitrogen and phosphorus by water hyacinths grown in a greenhouse for a 5-week period

Concentration of N or P	Daily absorption rate of:		N:P ratio
	N <sup>1</sup>	P	
50	2.4	0.4	6:1
100	2.4	0.4	6:1
250	3.5	0.7	5:1

<sup>1</sup>N is the sum of the average ammonium-nitrogen plus nitrate-nitrogen values.

the roots. This would tend to strengthen the assumption that the ammonium-nitrogen was taken up as such and was not nitrified to nitrate-nitrogen before it was lost from the waters.

#### Removal of Phosphorus

Phosphorus was not removed from the waters as rapidly as nitrogen (Figure 3). The rates of P uptake from the 50, 100, and 250 ppm phosphate-phosphorus treatments averaged 13, 25, and 35 ppm respectively during the 5-week test.

At the highest level (250 ppm -P), phosphorus apparently was released to the waters during the first 3 weeks of the experiment. Other researchers have noted similar temporary P increases in waters containing water hyacinths

grown in high concentrations of P. The net effect during the 5-week test, however, was a lowering of the P level in all instances. But these P losses did not begin to approach the plant's ability to scavenge N from eutrophic waters.

These data, summarized in Table 1, indicated that the N:P uptake ratio ranged from 5:1 to 6:1. These values correspond closely to the N:P ratio values which other workers have determined for the plant itself.

Another series of experiments was conducted to determine the amounts of chemically pure water that the water hyacinth was capable of pumping into the atmosphere via evapotranspiration. These losses from eutrophic waters were shown to exceed evaporation by as much as 320 percent. This meant pure water was being rapidly recycled back into the natural hydrological cycle from a contaminated source.

In conclusion, it has been demonstrated in the greenhouse that the prolific water hyacinth may someday be a useful aid in the cleanup of waters contaminated by large amounts of N and P. It is also a valuable contributor of pure water into the hydrologic cycle when grown in highly eutrophic waters.

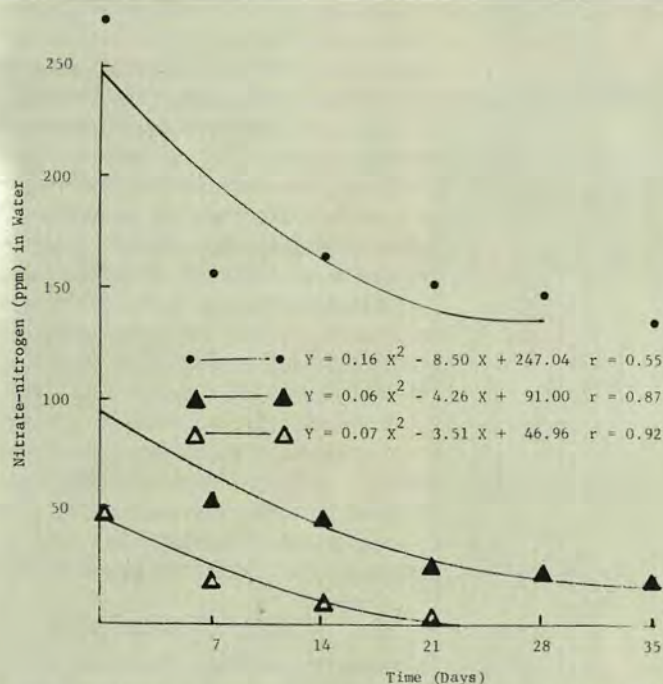


Fig. 2.—The change in aqueous concentration of 50, 100, and 250 ppm of nitrate-nitrogen as affected by the growth of water hyacinths in a greenhouse.

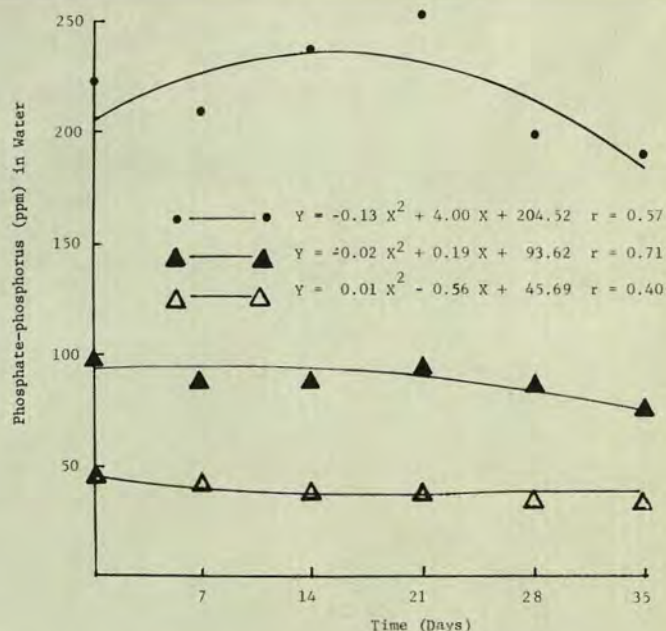


Fig. 3.—The change in aqueous concentration of 50, 100, and 250 ppm of phosphate-phosphorus as affected by the growth of water hyacinths in a greenhouse.

# Modified auction price reporting of calves and yearlings

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*Department of Agricultural Economics and Agribusiness*

**B**EEF CATTLE price reporting for auction markets has traditionally emphasized the current market situation. The classifications used in the reports provided useful marketing information for producers but were inadequate for sound production planning.

For example, for many years a calf or yearling sold at a Louisiana auction market was classified in the Louisiana *Livestock Market Report* in one of five classifications: (1) slaughter calves, (2) slaughter steers and heifers, (3) stocker calves, (4) stocker steers, and (5) stock-

er heifers. These classifications were too broad and ill-defined. Furthermore, they frequently designated the type of buyer rather than described the animal.

A study was initiated in the Department of Agricultural Economics and Agribusiness in August 1972 to determine what modifications were needed in the Louisiana Market News Service reporting classifications to provide beef producers with price data better suited for production as well as marketing decisions.<sup>1</sup>

## Method of Analysis

In the study, weight, price, and sex data were obtained from one auction located in each of four areas of Louisiana: Northeast, Northwest, Central, and Southwest. Data were obtained from all regular weekly sales of calves and yearlings within the 150- to 800-pound liveweight range for the 2-year period June 28, 1970, through June 27, 1972. The sample included 158,192 observations (animal sales) consisting of 73,937 steers, 41,655 heifers, and 42,600 head upon which sex identification could not be determined. Analyses were made for each of the four individual auction locations separately and for the four auctions combined. Relationships observed for individual auctions indicated the data could be treated as a single population.

Data for the 2-year period were combined by weeks to determine seasonal price patterns. Animal weights were initially categorized into 26 groups of 25-pound intervals each. Seasonal patterns of prices for all animals were computed for each of the 26 weight groups. Successive weight groups were then combined if seasonal patterns were not significantly different. The six groups resulting from differences in seasonal price patterns were, in pounds, 150-275, 276-375, 376-500, 501-600, 601-675, and 676-800. Table 1 shows, for the six weight groups, number of animals, average prices, and average weights for the sales data obtained from the four auctions.

Analysis of covariance was used to determine the effects of selected factors

<sup>1</sup>For a comprehensive report of this research, see Fielder, Lonnie L. and Adolfo Martinez, *Weight-Price Relationships for Calves, Steers and Heifers Marketed through Louisiana Auctions*, D.A.E. Research Report No. 464, Baton Rouge: Louisiana Agricultural Experiment Station, May 1974. Available upon request.



The new Louisiana livestock market reports more accurately reflect prices for specific classes of cattle sold through auction markets.

on prices of steers and heifers within the six weight groupings. Significant differences in price were found among auction locations, sex groups, and weight groups.

#### Price Classes Revised

The significant differences in price associated with factors observed in this study indicated that weight, sex, market location, and their allied seasonal variations should be accounted for in a price reporting system. Based on the findings of this study, the Louisiana Department of Agriculture revised the auction reporting classifications for calves, steers, and heifers, effective March 1, 1974. The revised classifications include sex distinction for the six weight groups established in the study as well as selective grade reporting. The new price reports will provide data that reflect cattle buyers' purchasing patterns and, subsequently, permit economic analyses that are more useful for production and marketing decisions.

#### Conclusions

Price relationships between various kinds of any commodity experience frequent change. For example, some price relationships at the present time are contrary to those existing during the period in which the six weight categories were established. During that period, there was an inverse relationship between weight of animal and price per hundredweight. This relationship existed primarily because of a positive feeding margin (cost per pound of gain less than price per pound of final product).

Recent extreme increases in feed grain prices and interest rates, coupled with depressed cattle prices, however, have resulted in a negative cattle feeding margin (cost per pound of gain greater than price per pound of final product). Therefore, present prices tend to exhibit a direct relationship between animal weight and price per hundredweight. If the negative feeding margin persists, as beef cattle prices stabilize, prices will reflect this direct weight-price relationship.

Price relationships among the weight groups established for auction price reporting purposes are in a state of change. However, the weight groupings are valid since, to a large extent, they reflect biological performance of animals. The Department of Agricul-

TABLE 1.—Average prices and weights for the six weight groups determined in the study for all animals, steers, and heifers, four Louisiana auction markets, June 28, 1970, through June 27, 1972

Weight interval	Number of observations <sup>1</sup>	Average price	Average weight
Pounds	Number	Dol./cwt.	Pounds
<b>All Animals</b>			
150-275	32,828	42.94	229.06
276-375	53,022	36.85	329.99
376-500	52,841	33.72	430.16
501-600	13,161	31.17	542.21
601-675	3,177	29.31	633.03
676-800	1,852	26.90	726.78
Weighted average		36.32	371.27
<b>Steers</b>			
150-275	14,942	45.85	230.84
276-375	25,164	38.89	330.17
376-500	25,314	35.40	430.52
501-600	5,714	32.38	541.63
601-675	1,229	30.27	634.65
676-800	809	28.34	729.76
Weighted average		38.33	370.64
<b>Heifers</b>			
150-275	8,632	39.61	233.64
276-375	14,872	34.40	328.85
376-500	13,340	31.69	428.91
501-600	2,947	29.23	543.70
601-675	826	26.65	636.22
676-800	553	24.73	731.25
Weighted average		33.96	368.24

<sup>1</sup>The number of observations for each class of animal is less than reported for the total sample due to exclusion of selected weight groupings in some auction markets where numbers were too small to permit valid statistical comparisons.

tural Economics and Agribusiness will monitor prices under the new reporting classifications. As soon as emerging patterns can be ascertained, price relationships and trends will be analyzed and reported, along with guidelines for

using the information for production and marketing decisions. Recommendations for modifications of the price reporting categories will also be made if emerging price relationships indicate such changes are needed.



## New Publications

Agricultural Experiment Station publications may be obtained free by residents of Louisiana from county and home demonstration agents or by writing to the Agricultural Experiment Station, LSU, Baton Rouge, 70803. Only one copy of each will be sent to an individual unless very good reasons are furnished for more. No more than five copies of a bulletin or one copy of five bulletins will be sent free to out-of-state residents. Additional bulletins or copies will be furnished at cost. Mailing address should include zip code.

Bul. No. 682—*The Coccinellidae of Louisiana (Insecta: Coleoptera)*. Joan B. Chapin.

Bul. No. 683—*Physical and Chemical Properties of Three Groups of Mississippi River Alluvial Soils in the Sugarcane Area of Louisiana*. Ray Ricaud, L. E. Golden and S. A. Lytle.

Bul. No. 684—*Influence of Annual Applications of Phosphorus on the Yield and Chemical Composition of Common Bermudagrass and on the Chemical Composition of a Bowie Soil*. C. L. Mondart, Jr., H. E. Harris, R. H. Brupbacher, Jr. and J. E. Sedberry, Jr.

# JASPER:

## A new sweet potato

(Continued from Page 3)

leaves, and petioles are green in color. Although plant production is adequate in most years, Jasper generally produces fewer plants per bushel of seed roots than Centennial. The plants grow vigorously in the field and should cover rows in 30 to 50 days.

The fleshy, well shaped roots of Jasper are oblong and tapered to both ends. In most soil types the roots resemble those of Centennial, but normally have a tougher and smoother exterior skin or periderm surface.

Jasper is as early as Centennial in production, if not earlier, and it produces a large percentage of marketable grade roots. The roots have approximately twice the carotene (provitamin A) content of Unit 1 Porto Rico. Jasper is similar to Goldrush in flesh color and dry matter content, but is lower in carotenoid pigments and dry matter content than Centennial (Table 1).

### Varietal Performance

Comparative data on yields of Jasper and Centennial are included in Table 1. Over a 3-year period Jasper produced an average of 314.3 bushels and Centennial 307.3 bushels of

TABLE 1—A 3-year comparison of Jasper and Centennial varieties (averages, 1971-73)

Variety	Total pigment (mg/100 gm)	Percent dry matter	Marketable roots per acre (bushels)		Canning index*	Baking index*
			Soil rot free soil	Soil rot infested soil		
Jasper	8.8	23-26	314.3**	425.2**	77.9	76.8
Centennial	11.7	25-29	307.3	85.9	74.8	71.5

\*The higher the index, the better the quality.

\*\*Tests conducted in different areas with different soil productivity levels.

TABLE 2.—Disease reaction of Jasper and other commercial varieties in Louisiana<sup>1</sup>

Diseases <sup>2</sup>	Jasper	Centennial	Goldrush	Unit 1 Porto Rico
Stem Rot	R	I	R	S
Internal Cork	R	I	S	S
Soil Rot	R	S	S	S
Root Knot	R-I	S	S	I-S
Black Rot	S	S	S	S
Sclerotial Blight	S	I-S	S	S
Scurf	S	S	S	S

<sup>1</sup>Disease reactions are based on comparative experiments and observations in Louisiana. S = susceptible (severe disease symptoms under a wide range of conditions); I = intermediate (mild disease symptoms ordinarily, but ranging to severe under some conditions); R = resistant (very mild or no disease symptoms under a wide range of conditions).

<sup>2</sup>Causal agents of the diseases: Stem Rot—*Fusarium oxysporum* f. *batatas*; Internal Cork—virus; Soil Rot—*Streptomyces ipomoea*; Root Knot—*Meloidogyne* spp.; Black Rot—*Ceratocystis fimbriata*; Sclerotial Blight—*Sclerotium rolfsii*; Scurf—*Monilochaetes infusans*.

marketable roots per acre in soil free of the soil rot organism. In soil rot infested soil, Jasper produced 425.2 bushels of marketable roots per acre compared with 85.9 bushels for Centennial.

Jasper is susceptible to black rot, sclerotial blight, and scurf. The reaction of Jasper and other commercial varieties to some of the sweet potato diseases found in Louisiana is shown in Table 2.

Quality evaluations were made on baked and canned samples of Jasper and Centennial in each of 3 years (1971-73). Samples were rated on eye appeal, color intensity, freedom from discoloration, smoothness, moistness, lack of fiber, and flavor. Each

category was rated from 1 to 10, with 10 being the best.

A weighted score was tabulated for each variety or seedling; the higher the weighted score, the better the quality. For the canning index, Jasper had a weighted score of 77.9, compared with 74.8 for Centennial. For the baking index, Jasper had a weighted score of 76.8 in comparison with 71.5 for Centennial.

Jasper keeps fairly well in storage, but it will not store as well for market purposes over as long a period as Centennial. It is recommended that Jasper be marketed early. In most cases it should not be stored for fresh market use beyond December of the year that it was grown.

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