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FORAGE NUTRITIVE QUALITY OF WEEDS IN ALABAMA

CONTENTS

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Forage Nutritive Quality of Weeds in Alabama

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WEEDS ARE OFTEN PRESENT in pasture, hay, and silage grown in the Southeastern United States. While it is generally recognized that weeds effectively compete with cultivated forages for moisture, fertility, and light, the contribution of many weed species to overall forage productivity and quality is not well known.

In England, weed species were found to differ considerably in forage quality (*1*). Many weed species in Minnesota had digestibility and crude protein values equal or superior to oats (*Avena sativa*) (*5*), but mineral content differed greatly among species. Palatability of many weed species to livestock was high and similar to that of oats.

Animal gains on grass-weed mixtures can be equal to gains on a pure stand of cultivated grasses (*9*). As grazing pressure increases in a pasture, selectivity by animals is decreased; thus, more weeds, regardless of quality and palatability, are consumed (*7*). In south Alabama, beef calf gains were higher on annual winter weeds in late winter on Coastal bermudagrass (*Cynodon dactylon*) pasture than later when the forage was strictly bermudagrass (*3*).

The nutritive value of common weed species in Alabama has not been previously reported. This publication summarizes the results of several experiments where the nutritive value was determined in weed species grown in nurseries at Auburn (shown in cover illustration) and harvested at different stages of maturity.

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TABLE 1. WEED AND FORAGE SPECIES ANALYZED FOR NUTRITIONAL VALUE

Common name	Botanical name
Cool-season species	
Forbs	
Carolina geranium	*Geranium carolinianum*
Cutleaf evening primrose	*Oenothera laciniata*
Henbit	*Lamium amplexicaule*
Virginia pepperweed	*Lepidium virginicum*
Curly dock	*Rumex crispus*
Grass weeds	
Virginia wildrye	*Elymus virginicus*
Wild oats	*Avena fatua*
Cheat	*Bromus secalinus*
Little barley	*Hordeum pusillum*
Cultivated forages	
Wrens Abruzzi rye	*Secale cereale*
Kentucky 31 tall fescue	*Festuca arundinacea*
Regal ladino clover	*Trifolium repens*
Hairy vetch	*Vicia villosa*
Warm-season species	
Forbs	
Sicklepod	*Cassia obtusifolia*
Coffee senna	*Cassia occidentalis*
Hemp sesbania	*Sesbania exaltata*
Tall morningglory	*Ipomoea purpurea*
Ivyleaf morningglory	*Ipomoea hederacea*
Cypressvine morningglory	*Ipomoea quamoclit*
Florida beggarweed	*Desmodium tortuosum*
Prickly sida	*Sida spinosa*
Common purslane	*Portulaca oleracea*
Bur gherkin	*Cucumis anguria*
Redroot pigweed	*Amaranthus retroflexus*
Jimsonweed	*Datura stramonium*
Maypop passionflower	*Passiflora incarnata*
Common ragweed	*Ambrosia artemisiifolia*
Common cocklebur	*Xanthium strumarium*
Pennsylvania smartweed	*Polygonum pensylvanicum*
Bristly starbur	*Acanthospermum hispidum*
Rough goldenrod	*Solidago rugosa*
Balloonvine	*Cardiospermum halicacabum*
Mexicantea	*Chenopodium ambrosioides*
Common pokeweed	*Phytolacca americana*
Blue vervain	*Verbena hastata*
Florida pusley	*Richardia scabra*
Citronmelon	*Citrullus lanatus*
Common lambsquarters	*Chenopodium album*
Horsenettle	*Solanum carolinense*
Grass weeds	
Fall panicum	*Panicum dichotomiflorum*
Texas panicum	*Panicum texanum*
Yellow foxtail	*Setaria lutescens*
Large crabgrass	*Digitaria sanguinalis*
Crowfootgrass	*Dactyloctenium aegyptium*
Goosegrass	*Eleusine indica*
Field sandbur	*Cenchrus incertus*
Cultivated forages	
Millex 23 pearlmillet	*Pennisetum americanum*
Coastal bermudagrass	*Cynodon dactylon*

EXPERIMENTAL PROCEDURE

Forage nutritional status was determined from samples collected from cool- and warm-season weed and cultivated forage species planted in a field at Auburn, Alabama, in Cowarts sandy loam, table 1. Plots were 5 x 5 feet with four replications, with sufficient space between plots to allow optimum growth of the species. The soil was limed and fertilized according to soil test recommendations for forage species. All nonlegume species were fertilized with 15 pounds nitrogen per acre at planting and 35 pounds nitrogen at three times during the growing season. Irrigation was applied to maintain vigorous growth during periods of low rainfall.

Forage was hand harvested from each plot for nutritional analyses at vegetative, flowering, and fruiting stages for two experiments. In some instances, forage was collected at only one or two stages of maturity. Nutritive quality was determined by in vitro dry matter digestibility (*8*), crude protein by macro-Kjeldahl N x 6.25, phosphorus by chlorostannous-reduced molydophosphoric acid blue color in sulfuric acid (*4*), and calcium, magnesium, and potassium by atomic absorption-emission spectrophotometry.

RESULTS

Digestibility is one of the best indicators of forage quality. Digestibility values of 60 percent or higher are considered good and should be satisfactory for growing cattle, while values of 50 percent or less are unsatisfactory, even for lactating beef cows. Crude protein levels of 11 percent or more are adequate for growing animals, whereas levels of 9 percent are needed for lactating beef cows. Phosphorus and magnesium levels of 0.2 percent, calcium levels of 0.3 percent, and potassium levels of 0.5-0.8 percent are required for beef cattle (*6*).

Cool-Season Weeds

Digestibility

Digestibility of the cool-season species was generally high at the vegetative stage of maturity, table 2. With the exception of cutleaf evening primrose and curly dock, digestibility was similar to or higher than that for rye and ladino clover, which are regarded as high quality forage plants. Digestibility of

TABLE 2. PERCENTAGE IN VITRO DRY MATTER DIGESTIBILITY (IVDMD) OF COOL-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	IVDMD		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Carolina geranium	78 b A*	70 d B	68 d B
Cutleaf evening primrose	72 c A	69 d A	52 g B
Henbit	—	78 bc A	75 bc A
Virginia pepperweed	86 a A	72 cd B	63 def C
Curly dock	73 c A	54 e B	51 g B
Grass weeds			
Virginia wildrye	80 b A	74 cd B	60 f C
Wild oats	75 bc	—	—
Cheat	81 ab A	69 d B	61 ef C
Little barley	82 ab A	78 bc A	62 ef B
Cultivated forages			
Rye	79 b A	81 ab A	70 cd B
Tall fescue	78 b A	73 cd A	67 de B
Ladino clover	81 ab A	85 a A	83 a A
Hairy vetch	80 b A	77 bc A	77 b A

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level as determined by Duncan's multiple range test. Any two means within a line followed by the same upper case letter are not significantly different at the 5 percent level as determined by Duncan's multiple range test.

TABLE 3. PERCENTAGE CRUDE PROTEIN OF COOL-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Crude protein		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Carolina geranium	18.7 e A*	13.8 gh B	10.6 fg C
Cutleaf evening primrose	19.6 de A	14.1 gh B	11.3 efg C
Henbit	—	20.1 de A	16.2 cd A
Virginia pepperweed	31.9 a A	25.8 ab B	17.1 c C
Curly dock	29.9 ab A	19.1 def B	16.1 cd C
Grass weeds			
Virginia wildrye	23.1 cd A	18.8 def B	6.8 h C
Wild oats	23.2 cd	—	—
Cheat	23.4 cd A	17.6 ef B	13.8 gh C
Little barley	23.6 c A	17.6 ef B	13.8 de C
Cultivated forages			
Rye	27.9 b A	24.2 bc B	13.4 de C
Tall fescue	22.1 cde A	16.5 fg B	12.5 ef C
Ladino clover	27.2 b A	22.1 cd B	23.2 b C
Hairy vetch	30.0 ab A	28.7 a A	26.2 a A

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most weed species declined faster than cultivated forages. The digestibility of grass weeds was similar to rye and tall fescue at the vegetative stage; however, digestibility of grass weeds was lower than rye at the oldest stage of maturity. Henbit and Carolina geranium maintained high digestibility at the oldest stage of maturity. Although there is a tendency for digestibility of some cool-season weeds to decline with maturity, the nutritive quality would generally be equal or superior to bermudagrass in early spring when it is most digestible, averaging 55 to 58 percent.

Crude Protein

At the vegetative stage of maturity, all weed species and cultivated forages were more than adequate to provide the protein requirement of 11 percent for a growing beef steer, table 3. Weed and cultivated forage species generally declined in percent crude protein as the plants matured. However, Virginia wildrye was the only weed that decreased enough in crude protein by the most mature stage that it would be inadequate for a growing steer or lactating beef cow. Crude protein content of henbit and hairy vetch was not significantly affected by maturity.

TABLE 4. PERCENTAGE CALCIUM OF COOL-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Calcium		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Carolina geranium	0.41 e C*	0.56 d B	0.69 c A
Cutleaf evening primrose	1.15 a B	1.29 a A	1.34 a A
Henbit	—	.69 c A	.57 d B
Virginia pepperweed	.66 c A	.67 c A	.53 d B
Curly dock	.29 fgh B	.49 d A	.52 d A
Grass weeds			
Virginia wildrye	.22 h A	.20 f AB	.15 g B
Wild oats	.33 f	—	—
Cheat	.31 fg A	.33 e A	.30 e A
Little barley	.25 gh A	.21 f B	.20 fg B
Cultivated forages			
Rye	.31 fg A	.29 ef AB	.26 ef B
Tall fescue	.27 fgh A	.31 e A	.27 ef A
Ladino clover	.75 b B	.80 b AB	.87 b A
Hairy vetch	.55 d A	.56 d A	.54 d A

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level as determined by Duncan's multiple range test. Any two means within a line followed by the same upper case letter are not significantly different at the 5 percent level as determined by Duncan's multiple range test.

TABLE 5. PERCENTAGE PHOSPHORUS OF COOL-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Phosphorus		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Carolina geranium	0.13 e A*	0.11 f B	0.09 de B
Cutleaf evening primrose	.16 de A	.15 cd AB	.14 abc B
Henbit	—	.20 ab A	.17 a B
Virginia pepperweed	.23 b A	.19 b AB	.14 abc B
Curly dock	.24 b A	.14 def B	.15 ab B
Grass weeds			
Virginia wildrye	.16 de A	.13 def A	.08 e B
Wild oats	.32 a	—	—
Cheat	.21 bc A	.17 bc B	.12 bcd C
Little barley	.17 de A	.14 cde B	.12 cd C
Cultivated forages			
Rye	.31 a A	.22 a B	.12 cd C
Tall fescue	.19 cd A	.14 cde A	.15 ab A
Ladino clover	.18 cd A	.11 ef B	.12 bcd B
Hairy vetch	.21 bc A	.18 bc B	.16 a B

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level as determined by Duncan's multiple range test. Any two means within a line followed by the same upper case letter are not significantly different at the 5 percent level as determined by Duncan's multiple range test.

TABLE 6. PERCENTAGE MAGNESIUM OF COOL-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Magnesium		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Carolina geranium	0.10 e A*	0.09 gh A	0.10 f A
Cutleaf evening primrose	.27 a A	.28 b A	.26 b A
Henbit	—	.39 a A	.33 a B
Virginia pepperweed	.18 bc A	.18 d A	.13 e B
Curly dock	.19 b B	.24 c A	.24 c A
Grass weeds			
Virginia wildrye	.10 e A	.07 hi B	.05 g C
Wild oats	.11 e	—	—
Cheat	.11 e A	.08 hi B	.07 g C
Little barley	.09 g A	.06 i B	.07 g B
Cultivated forages			
Rye	.11 e A	.11 fg A	.09 f A
Tall fescue	.13 d A	.12 f A	.12 e A
Ladino clover	.16 c B	.14 e C	.18 d A
Hairy vetch	.13 d A	.13 ef A	.13 e A

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level as determined by Duncan's multiple range test. Any two means within a line followed by the same upper case letter are not significantly different at the 5 percent level as determined by Duncan's multiple range test.

Mineral Content

Cool-season weeds contained enough calcium to provide adequate amounts for growing beef steers, table 4. Cutleaf evening primrose contained high levels of calcium at all maturity stages, exceeding that of ladino clover. Only Virginia wildrye had a marginal level of calcium as required for beef cattle.

Of the weed species, only Virginia pepperweed, curly dock, wild oats, and cheat had adequate phosphorus at the vegetative stage to meet the needs of a growing beef steer, table 5. At the flowering stage, henbit and Virginia pepperweed were the only ones with adequate phosphorus levels. Levels of phosphorus in both weed and forage species, except tall fescue, declined as plants matured. All weeds and cultivated forages had phosphorus concentrations below adequate levels at the oldest stage of maturity.

Magnesium levels of less than 0.2 percent may cause grass tetany in lactating beef cows during late winter and spring. All of the cool-season grass weeds, cultivated forages, and some of the cool-season forbs had magnesium concentrations often associated with grass tetany, table 6. Weeds likely to

TABLE 7. PERCENTAGE POTASSIUM OF COOL-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Potassium		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Carolina geranium	1.0 f AB*	1.2 de A	1.0 d B
Cutleaf evening primrose	1.2 ef A	1.2 d A	1.0 d B
Henbit	—	1.0 e A	.9 de B
Virginia pepperweed	1.4 cde A	1.3 d A	1.0 d B
Curly dock	2.2 b A	2.0 a AB	1.9 a B
Grass weeds			
Virginia wildrye	1.3 de A	1.4 cd A	.6 e B
Wild oats	2.5 a	—	—
Cheat	1.0 f AB	1.2 de A	1.0 d B
Little barley	1.4 cde A	1.4 cd A	1.2 cd B
Cultivated forages			
Rye	2.4 ab A	1.6 bc B	1.4 bc B
Tall fescue	1.6 c A	1.7 b A	1.4 bc B
Ladino clover	1.4 cd B	1.6 bc A	1.6 ab A
Hairy vetch	1.3 de B	1.6 bc A	1.6 b A

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cause tetany included Carolina geranium, Virginia wildrye, wild oats, cheat, and little barley. Although the grass weeds were low in magnesium, all forbs except Carolina geranium and Virginia pepperweed had adequate or nearly adequate magnesium concentrations, particularly at later stages of growth.

All weed and cultivated forage species had potassium levels well above the requirements for cattle, table 7. Wild oats and rye had the highest levels of potassium at the vegetative stage. Generally, potassium concentrations declined as plants matured.

Warm-Season Weeds (1977)

Digestibility

At the vegetative state, all warm-season weeds except crowfootgrass were more digestible than pearlmillet or bermudagrass, table 8. All of the grass weeds and bermudagrass were

TABLE 8. PERCENTAGE IN VITRO DRY MATTER DIGESTIBILITY (IVDMD) OF WARM-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	IVDMD		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Sicklepod	84 a A*	76 ab B	71 abc B
Coffee senna	81 abc A	75 abc A	67 bcd B
Hemp sesbania	70 cd A	66 bcd A	52 gh B
Tall morningglory	82 ab A	—	76 ab B
Ivyleaf morningglory	80 abc A	—	78 a A
Cypressvine morningglory	80 abc A	—	77 ab A
Florida beggarweed	74 abcd A	65 bcd B	55 efg C
Prickly sida	80 abc A	70 abcd B	56 efg C
Common purslane	—	80 a	—
Bur gherkin	—	75 abc A	79 a A
Redroot pigweed	73 abcd A	71 abcd A	64 cde B
Jimsonweed	72 abcd A	66 bcd A	56 defg B
Grass weeds			
Fall panicum	72 bcd A	63 cde B	54 efg C
Texas panicum	74 abcd A	62 de B	52 fgh C
Yellow foxtail	73 abcd A	66 bcd B	57 defg C
Crabgrass	79 abc A	72 abcd B	63 cdef C
Crowfootgrass	67 de A	54 ef B	43 hi C
Cultivated forages			
Pearlmillet	59 e A	60 def A	60 defg A
Bermudagrass	58 e A	51 f B	43 hi C

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more digestible at the vegetative stage than at the flowering or fruiting state. Some forbs decreased in digestibility, particularly at the fruiting stage; however, the morningglories, bur gherkin, and pearlmillet remained unchanged at all stages. In contrast, bermudagrass declined sharply with maturity, similar to crowfootgrass, resulting in poor quality forage.

Crude Protein

Both weed and cultivated forage species had more than adequate crude protein at the vegetative stage to meet the requirements of growing beef steers, table 9. Most of the forbs were especially high in crude protein. Grass weeds were lower than most forbs but were comparable to both bermudagrass and pearlmillet at the vegetative stage.

Concentrations of crude protein usually decreased when plants matured past the vegetative stage. At advanced matur-

TABLE 9. PERCENTAGE CRUDE PROTEIN OF WARM-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Crude protein		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Sicklepod	21.6 cd A*	13.6 c C	16.7 a B
Coffee senna	16.5 fgh B	21.8 a A	15.2 abc B
Hemp sesbania	31.2 a A	13.9 c B	11.2 def B
Tall morningglory	20.1 de A	—	13.9 abcd B
Ivyleaf morningglory	19.3 def A	—	11.0 defg B
Cypressvine morningglory	20.3 de A	—	13.2 bcde B
Florida beggarweed	21.9 cd A	16.9 b B	12.9 cde C
Prickly sida	17.2 efgh A	17.7 b A	12.3 cde B
Common purslane	—	19.3 ab	—
Bur gherkin	—	17.3 b A	14.2 abcd A
Redroot pigweed	23.9 bc A	17.4 b B	10.6 efgh C
Jimsonweed	25.1 b A	20.7 a B	16.5 ab C
Grass weeds			
Fall panicum	19.0 defg A	9.1 de B	7.2 hi B
Texas panicum	15.7 h A	10.5 de B	8.4 fghi C
Yellow foxtail	17.5 efgh A	11.5 de C	14.3 abcd B
Crabgrass	14.3 h A	8.1 ef B	6.4 i B
Crowfootgrass	15.5 h A	7.9 ef B	8.5 fghi B
Cultivated forages			
Pearlmillet	17.3 efgh A	6.0 f C	8.3 fghi B
Bermudagrass	15.9 gh A	6.9 de C	7.7 ghi B

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ities, the grass weeds (except for yellow foxtail) generally had crude protein concentrations that would be inadequate for growing steers, but the same was true for the cultivated forages. However, these crude protein levels would be adequate for maintenance of a dry pregnant cow. Forbs remained at a relatively high level of crude protein even at fruiting stage.

Mineral Content

Warm-season weed and cultivated forage species contained calcium concentrations above the requirements of cattle, table 10. Forbs were high in calcium, sometimes two to three times higher than some grass weed and cultivated grass species. Bur gherkin had an unusually high calcium concentration of 3.0 percent; other forbs ranged between 0.7 and 1.9 percent calcium. With the exception of crowfootgrass, the grass weeds had calcium levels similar to pearlmillet and bermudagrass.

TABLE 10. PERCENTAGE CALCIUM OF WARM-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Calcium		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Sicklepod	1.12 cd A*	1.35 c A	1.31 bc A
Coffee senna	1.14 cd B	1.24 cd A	1.16 cd AB
Hemp sesbania	.96 d A	1.02 def A	.92 ef A
Tall morningglory	1.02 d A	—	.94 ef A
Ivyleaf morningglory	.72 e A	—	.76 fg A
Cypressvine morningglory	.98 d A	—	.79 fg B
Florida beggarweed	1.88 a A	1.47 c B	1.25 bcd C
Prickly sida	1.04 d A	1.03 def A	1.13 cde A
Common purslane	—	.90 ef	—
Bur gherkin	—	3.01 a A	2.96 a A
Redroot pigweed	1.32 b C	1.80 b A	1.46 b B
Jimsonweed	1.26 cb A	1.06 de B	1.01 def B
Grass weeds			
Fall panicum	.33 g B	.36 g AB	.40 h A
Texas panicum	.53 f A	.49 g A	.54 gh A
Yellow foxtail	.41 fg A	.38 g A	.33 h A
Crabgrass	.44 fg A	.42 g A	.39 h A
Crowfootgrass	.71 e C	.80 f B	.96 ef A
Cultivated forages			
Pearlmillet	.48 fg A	.42 g AB	.33 h B
Bermudagrass	.42 gh A	.44 g A	.40 h A

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level according to Duncan's multiple range test. Any two means within a line followed by the same upper case letter are not significantly different at the 5 percent level according to Duncan's multiple range test.

TABLE 11. PERCENTAGE PHOSPHORUS OF WARM-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Phosphorus		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Sicklepod	0.13 g A*	0.09 e A	0.11 d A
Coffee senna	.14 g A	.14 de A	.16 cd A
Hemp sesbania	.33 d A	.16 de B	.11 d B
Tall morningglory	.15 fg A	—	.14 cd A
Ivyleaf morningglory	.16 fg A	—	.22 bc A
Cypressvine morningglory	.17 fg A	—	.19 bcd A
Florida beggarweed	.16 fg A	.12 e B	.18 cd A
Prickly sida	.13 g A	.16 cde A	.19 bcd A
Common purslane	—	.35 a	—
Bur gherkin	—	.27 b A	.23 bc A
Redroot pigweed	.55 b A	.39 a B	.42 a AB
Jimsonweed	.39 cd A	.22 bcd B	.37 a A
Grass weeds			
Fall panicum	.36 cd A	.23 bcd B	.21 bcd B
Texas panicum	.24 ef A	.17 cde A	.20 bcd A
Yellow foxtail	.31 de A	.22 bcd B	.22 bc B
Crabgrass	.43 c A	.25 bc B	.17 cd C
Crowfootgrass	.34 d A	.18 bcde B	.19 cd B
Cultivated forages			
Pearlmillet	.69 a A	.25 bc B	.21 bcd B
Bermudagrass	.20 fg A	.15 de A	.18 cd A

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level according to Duncan's multiple range test. Any two means within a line followed by the same upper case letter are not significantly different at the 5 percent level according to Duncan's multiple range test.

Calcium content of crowfootgrass increased while Florida beggarweed decreased with maturity.

Many of the weed species were low in phosphorus and would be suboptimal for a high producing ruminant, table 11. Sicklepod, coffee senna, the morningglory species, Florida beggarweed, and prickly sida had suboptimal levels at the vegetative stage. Phosphorus concentrations in redroot pigweed, jimsonweed, and crabgrass were generally higher than many other weed species. Phosphorus concentration of pearlmillet was substantially higher than bermudagrass at the first two maturities. The majority of the forbs did not change substantially in phosphorus concentrations as plants matured.

All warm-season weeds and cultivated grasses at all stages of maturity had magnesium concentrations adequate for cattle, table 12. Redroot pigweed and bur gherkin had the highest magnesium concentration at fruiting stage, 0.77 and 0.95, respectively.

TABLE 12. PERCENTAGE MAGNESIUM OF WARM-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Magnesium		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Sicklepod	0.35 b A*	0.32 efgh B	0.36 de A
Coffee senna	.32 bcd B	.43 e A	.40 d A
Hemp sesbania	.34 bcd A	.29 fgh B	.22 g C
Tall morningglory	.35 bc A	—	.36 de A
Ivyleaf morningglory	.30 bcd A	—	.36 de A
Cypressvine morningglory	.32 bcd A	—	.31 ef A
Florida beggarweed	.31 bcd A	.25 gh B	.19 g C
Prickly sida	.32 bcd B	.39 ef A	.35 de AB
Common purslane	—	1.25 a	—
Bur gherkin	—	.73 c B	.95 a A
Redroot pigweed	.71 a B	.96 b A	.77 b B
Jimsonweed	.66 a A	.58 d A	.57 c A
Grass weeds			
Fall panicum	.31 bcd A	.21 h B	.30 ef A
Texas panicum	.39 b A	.35 efg A	.38 d A
Yellow foxtail	.22 d A	.21 b A	.25 fg A
Crabgrass	.35 b AB	.33 efgh B	.39 d A
Crowfootgrass	.38 b A	.33 efgh A	.36 de A
Cultivated forages			
Pearlmillet	.33 bcd A	.20 B	.22 g B
Bermudagrass	.23 cd A	.22 b A	.22 g A

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level according to Duncan's multiple range test. Any two means within a line followed by the same upper case letter are not significantly different at the 5 percent level according to Duncan's multiple range test.

The majority of weed species were as high in potassium as bermudagrass, table 13, with yellow foxtail and pearlmillet highest at the vegetative stages (5.0 and 4.8 percent, respectively). Generally, potassium concentration decreased as plants matured.

Warm-Season Weeds (1980)

Digestibility

Except for blue vervain and Pennsylvania smartweed, digestibility of all weed species at the vegetative stage was equal to or higher than that of pearlmillet, table 14. Generally, digestibility of most weeds declined sharply with maturity. Digestibility of maypop passionflower and Florida pusley remained high at fruiting, well above that of pearlmillet. Pennsylvania smartweed and blue vervain had extremely low digestibility values, indicating poor forage quality.

TABLE 13. PERCENTAGE POTASSIUM OF WARM-SEASON WEED AND FORAGE SPECIES AT THREE STAGES OF MATURITY

Species	Potassium		
	Vegetative	Flower/boot	Fruit/head
	Pct.	*Pct.*	*Pct.*
Forbs			
Sicklepod	2.6 ef A*	1.7 h B	1.6 gh B
Coffee senna	2.3 fg A	2.3 fg A	1.8 fgh A
Hemp sesbania	3.7 bc A	2.3 fg B	1.4 b C
Tall morningglory	3.1 de A	—	2.7 b A
Ivyleaf morningglory	3.3 cd A	—	2.3 bcd B
Cypressvine morningglory	3.1 de A	—	2.4 bcd B
Florida beggarweed	2.4 fg A	1.6 h B	1.6 gh B
Prickly sida	2.0 g A	1.7 g B	1.9 fgh A
Common purslane	—	3.8 ab	—
Bur gherkin	—	3.4 bcd A	3.1 a A
Redroot pigweed	3.7 bc A	3.5 bc A	3.1 a B
Jimsonweed	3.9 b A	3.4 bcd A	3.3 a A
Grass weeds			
Fall panicum	3.5 bcd A	2.6 f B	2.4 bcde C
Texas panicum	3.5 bcd A	3.1 de B	2.5 bcd C
Yellow foxtail	5.0 a A	4.1 a B	3.3 a B
Crabgrass	4.0 b A	3.2 cd B	2.2 cdef C
Crowfootgrass	3.7 bc A	2.7 ef B	2.1 def C
Cultivated forages			
Pearlmillet	4.8 a A	3.0 de B	2.6 bc B
Bermudagrass	2.3 fg A	2.0 gh B	1.9 fgh B

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level according to Duncan's multiple range test. Any two means within a line followed by the same upper case letter are not significantly different at the 5 percent level according to Duncan's multiple range test.

Crude Protein

Crude protein values were lower in this experiment than in the previous one, indicating that nitrogen fertilization may have been inadequate because of heavy rains that caused excessive leaching. Even so, there were striking differences in crude protein contents of the weed species, table 14. Maypop passionflower, common ragweed, goosegrass, common pokeweed, Florida pusley, citronmelon, and horsenettle all had relatively high levels of crude protein at the vegetative stage. It is probable that the high crude protein value for horsenettle may not be protein but consists of nitrate since this species has been suspected to accumulate high levels of nitrates. With maturity, crude protein levels declined in most species, being especially low in Pennsylvania smartweed and common lambsquarters.

TABLE 14. PERCENTAGE IN VITRO DRY MATTER DIGESTIBILITY (IVDMD) AND CRUDE PROTEIN OF WARM-SEASON WEED AND FORAGE SPECIES AT TWO STAGES OF MATURITY, 1980

Species	IVDMD		Crude protein	
	Vegetative	Fruit/head	Vegetative	Fruit/head
	Pct.	*Pct.*	*Pct.*	*Pct.*
Forbs				
Florida pusley	77 a A*	70 a B	14.4 cd A	9.5 cde B
Common cocklebur	76 ab A	59 cd B	10.6 ef A	7.4 efgh A
Maypop passionflower	76 ab A	70 a A	23.6 a A	14.9 a B
Common pokeweed	75 abc A	57 de B	17.1 bc A	12.3 b B
Mexicantea	71 bcd A	47 g B	12.4 de A	7.1 gh B
Citronmelon	71 bcd A	59 cd B	19.2 b A	11.1 bc B
Balloonvine	70 bcd A	61 bcd B	12.4 de A	10.7 bcd A
Common lambsquarters	69 cde A	53 ef B	8.9 fg A	6.3 hi B
Common ragweed	66 def A	64 bc A	16.5 bc A	10.6 bcd B
Bristly starbur	63 efg A	50 fg B	10.1 ef A	8.9 cdefg A
Horsenettle	60 fg A	55 def A	24.6 a A	12.6 b B
Goldenrod	54 hi A	53 ef A	10.6 ef A	7.8 efgh A
Blue vervain	52 ij A	41 h B	6.8 g A	9.5 cdef A
Pennsylvania smartweed	47 j A	45 gh A	8.9 fg A	4.2 i A
Grass weeds				
Crabgrass	75 ab A	66 ab B	9.0 fg A	10.3 bcd A
Goosegrass	75 ab A	53 ef B	17.5 b A	8.5 defg B
Field sandbur	66 de A	56 de B	10.3 ef A	7.4 efgh B
Cultivated forage				
Pearlmillet	59 gh A	60 cd A	10.0 ef A	9.5 cdef A

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level. Two means within a line for maturity date of IVDMD or crude protein followed by the same upper case letter are not significantly different at the 5 percent level.

Mineral Content

Calcium content of all species was adequate for cattle nutrition, table 15. Florida pusley was much higher in calcium content than any other species.

Many weed species contained inadequate phosphorus for cattle nutrition, table 15. Goosegrass, bristly starbur, crabgrass, common ragweed, common cocklebur, citronmelon, and field sandbur had the highest levels of phosphorus. Weeds having extremely low levels of phosphorus were Pennsylvania smartweed, goldenrod, common lambsquarters, mexicantea, common pokeweed, maypop passionflower, and Florida pusley.

Magnesium concentration of all species was relatively high, table 15, with common lambsquarters rated very high. There was little change in magnesium concentration with maturity.

Potassium concentration of all species was relatively high (adequate for animal nutrition), table 15. Common pokeweed

TABLE 15. PERCENTAGE CALCIUM, POTASSIUM, MAGNESIUM, AND PHOSPHORUS OF WARM-SEASON WEED AND FORAGE SPECIES AT TWO STAGES OF MATURITY, 1980

Species	Calcium		Potassium		Magnesium		Phosphorus	
	Vegetative	Fruit/head	Vegetative	Fruit/head	Vegetative	Fruit/head	Vegetative	Fruit/head
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Forbs								
Florida pusley	2.28 a B*	3.75 a A	1.5 g B	2.8 bcd A	0.38 ghi A	0.58 ab A	0.09 k A	0.13 d A
Common cocklebur	1.98 b A	1.73 cd A	2.9 cd A	2.1 efgh B	.65 bc A	.50 bc A	.22 cdef A	.18 bc A
Maypop passionflower	1.25 ef B	1.88 c A	2.8 cde A	2.7 bcd A	.41 fgh A	.46 cde A	.14 hi A	.13 d A
Common pokeweed	.70 ij A	.61 ghij A	6.8 a A	3.0 ab B	.68 b A	.67 a A	.13 ij A	.08 e A
Mexicantea	1.10 fg A	.67 ghij B	3.0 cd A	2.1 fgh B	.54 de A	.38 efghi A	.10 jk A	.06 e A
Citronmelon	1.38 cde B	2.43 b A	2.4 ef A	2.1 efgh A	.43 fg A	.45 cdef A	.30 b A	.21 ab B
Balloonvine	.61 j A	.71 ghi A	1.7 g A	1.8 hi A	.34 hij A	.37 fghi A	.17 gh A	.20 abc A
Common lambsquarters	1.55 c A	.86 g B	4.0 b A	2.0 fgh B	.79 a A	.47 cd B	.10 jk A	.08 c A
Common ragweed	1.45 cd A	1.75 cd A	3.0 cd A	2.8 bcd A	.55 de A	.52 bc A	.21 def A	.17 cd A
Bristly starbur	.76 hij B	1.23 ef A	3.2 cd A	3.0 bc A	.45 fg A	.44 cdefg A	.24 cd A	.19 bc A
Horsenettle	.93 gh A	.76 gh A	2.3 f A	2.4 cdef A	.49 ef A	.39 defgh A	.19 efg A	.13 d A
Goldenrod	.94 gh A	1.15 f A	3.0 cd A	1.8 ghi B	.31 ij A	.27 j A	.10 jk A	.08 e A
Blue vervain	1.35 de A	1.48 de A	1.2 g A	1.4 ij A	.37 ghi A	.37 efghi A	.18 fg A	.17 cd A
Pennsylvania smartweed	.92 gh A	.65 ghij B	.6 g A	1.1 j A	.59 cd A	.47 cd A	.10 jk A	.06 e A
Grass weeds								
Crabgrass	.33 k A	.43 ij A	3.6 bc A	3.5 a A	.30 ij A	.38 efghi A	.22 cde A	.19 bc A
Goosegrass	.88 hi A	.68 ghij A	2.9 cde A	2.4 bcdefg A	.49 ef A	.36 ghi A	.25 c A	.16 cd A
Field sandbur	.29 h A	.41 j A	3.1 cd A	2.6 bcde A	.26 jk A	.32 hij A	.37 A	.26 a B
Cultivated forage								
Pearlmillet	.66 j A	.50 hij A	3.8 b A	2.1 efgh B	.20 h A	.29 ij A	.24 cd A	.19 bc A

*Any two means within a column followed by the same lower case letter are not significantly different at the 5 percent level. Two means within a line for maturity of each mineral followed by the same upper case letter are not significantly different at the 5 percent level.

had an extremely high content of potassium, over 6 percent at the vegetative stage and 3 percent at fruiting.

DISCUSSION

Many of the cool-season weeds, particularly at an early stage of maturity, were found to have quality comparable to commonly grown cool-season cultivated forage species. Although the digestibility of cool-season weeds declines with maturity, the weed nutritive quality was generally superior to warm-season perennial grasses such as bermudagrass. Crude protein content of cool-season weeds was high and more than adequate for cattle. Cool-season weeds had adequate levels of calcium and potassium. Phosphorus and magnesium levels were low in most weed species and could be nutritionally deficient for cattle.

Many warm-season weeds at the vegetative stage had a nutrient concentration comparable to that of cultivated forage grasses of the same season, such as Coastal bermudagrass and pearlmillet. Digestibility of most warm-season weeds sampled in these studies at the vegetative stage was superior to that of Coastal bermudagrass and equal to pearlmillet. Crabgrass, a highly palatable weed, had relatively high digestibility at all stages of maturity. Several weeds, such as Pennsylvania smartweed and blue vervain, were low in digestibility, indicating poor forage quality.

Crude protein content of warm-season weed species at the vegetative stage was generally high and equal or superior to that of bermudagrass. However, crude protein content of grass weeds declined with maturity so they would be adequate only for maintenance of dry cows. Forbs maintained a relatively high crude protein level even at the fruiting stage. Pennsylvania smartweed had extremely low crude protein at fruiting stage. Calcium, magnesium, and potassium levels of warm-season weeds were relatively high. Phosphorus content of many warm season weeds was low and inadequate for cattle nutrition.

Certain weeds can be useful forage plants in pastures. For example, palatable weeds such as crabgrass can be highly productive when adequately fertilized. However, other weeds have yield and palatability limitations. Such weeds as pokeweed, jimsonweed, and horsenettle may be mildly toxic (2), but a greater problem may be low palatability. Examples of unpalatable weeds are sicklepod, coffee senna, hemp sesbania,

prickly sida, jimsonweed, common ragweed, goldenrod, goosegrass, common pokeweed, horsenettle, and field sandbur. Intake of these unpalatable weeds by a grazing animal would be low; however, many of these weeds may be incorporated in hay or silage and be consumed by livestock.

Many weed species can be desirable components of a pasture and are readily grazed by cattle desiring variety in their diet. Weeds probably contribute more to livestock nutrition than is generally recognized. The high nutritive quality of many weed species suggests that it may not always be desirable to eliminate them from pastures.

SUMMARY AND CONCLUSIONS

Warm- and cool-season weed species were grown in the field at Auburn, Alabama, and digestibility, crude protein, and mineral content compared with cultivated forage species.

Cool-season weeds had high digestibility and crude protein at the vegetative stage, being comparable in quality to cultivated cool-season forage species. Even at more mature stages, nutritive quality of cool-season weeds was generally superior to bermudagrass.

Cool-season weeds had adequate levels of calcium and potassium for beef cattle nutrition, but were often low in phosphorus and magnesium.

Warm-season weeds generally were superior in digestibility to bermudagrass and most were equal to pearlmillet at the vegetative state. Crude protein content of warm-season weeds was comparable to bermudagrass at the vegetative stage but declined with maturity. Crabgrass maintained relatively high quality at all stages of maturity.

Calcium, magnesium, and potassium levels of warm-season weeds were generally high. Phosphorus content of many warm-season weeds was low and inadequate for beef cattle.

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