**Table 1.** Means for forage biomass (FB) and nutritional composition of alternative forage crops during the 2015 spring season (only one harvesting schedule)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variable** | **Alternative forage crops** | | | | | **SEM** | ***P*-value** |
| **Wheat** | **Triticale** | **Barley** | **Cereal rye** | **Hairy vetch** |
| FB, kg/ha | 1005.1a | 978.5a | 31.6b | 740.0ab | 345.6ab | 179.2 | 0.0091 |
| CP, % | 18.0c | 15.3c | 28.3b | 16.8c | 35.3a | 1.31 | < 0.0001 |
| SP, % CP | 44.0a | 44.2a | 45.4a | 44.0a | 40.7b | 0.72 | 0.0101 |
| ADF, % | 30.4a | 28.7a | 23.7b | 27.2ab | 28.2ab | 1.02 | 0.0144 |
| NDF, % | 51.6a | 48.0a | 36.7b | 48.5a | 35.7b | 1.27 | < 0.0001 |
| Lignin, % | 2.27b | 2.12b | 2.49b | 2.12b | 6.95a | 0.56 | 0.0002 |
| NFC, % | 16.8ab | 24.3a | 21.8ab | 21.3a | 11.8b | 2.16 | 0.0109 |
| EE, % | 3.75bc | 3.42c | 6.46a | 4.17bc | 4.60b | 0.24 | 0.0012 |
| TDN, % | 70.7b | 72.2ab | 74.4a | 73.2ab | 66.2c | 0.72 | < 0.0001 |
| Ash, % | 9.78b | 8.96b | 10.7b | 9.04b | 13.1a | 0.35 | < 0.0001 |

CP = crude protein; SP = soluble protein; ADF = acid detergent fiber; aNDF = neutral detergent fiber; NFC = nonfiber carbohydrate [100% - (CP% + NDF% + Fat% + Ash%)]; EE = ether extract; TDN = total digestible nutrients; SEM = standard error of the mean

a-c Means followed by different letters in the same row differ at 5% significance by the Tukey test.

**Table 2.** Means for forage biomass production, and nutritional composition of annual forage crops under three harvestings schedule during the summer 2015

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Harvest1** | **Annual forage crops** | | | | | | **SEM2** | ***P*- value** |
| **BMR Sorghum** | **Buckwheat** | **Teff** | **Millet** | **Oats** | **Chickling Vetch** |
|  | **Forage biomass Kg/ha** | | | | | |  | |
| 1  2  3 | 446.1Bbc  1,065ABcd  1,723Ab | 1,857Ba  3,335Aa  4,148Aa | 208.5Bbc  610.1Ad  972.8Abc | 1,034Cabc  2,104Bbc  3,307Aa | 1250.5Bab  2673.1Aab  3493.3Aa | 89.5Bc  269.2Ad  339.8Ac | 216.2 | < 0.0001 |
|  | **Crude protein (%)** | | | | | |  | |
| 1  2  3 | 18.3Abc  10.7Bb  8.65Bb | 12.1Ac  9.17Ab  8.30Ab | 19.8Aab  12.7Bb  9.85Bb | 14.4Abc  9.27Ab  7.60Bb | 16.4Abc  10.6ABb  8.22Bb | 26.1Aa  29.0Aa  28.3Aa | 1.39 | 0.0019 |
|  | **Lignin (%)** | | | | | |  | |
| 1  2  3 | 3.22Ab  2.05Abc  2.37Ab | 10.0Aa  9.40Aa  11.62Aa | 2.65Ab  1.80Ac  3.22Ab | 2.42Ab  2.42Abc  3.27Ab | 2.30Ab  3.17Abc  4.00Ab | 4.02Bb  4.72Bb  9.30Aa | 0.512 | 0.0003 |
|  | **Non-fiber carbohydrates (%)** | | | | | |  | |
| 1  2  3 | 11.5Ab  20.0Ab  16.9Ab | 28.7Aa  30.8Aa  31.2Aa | 10.2Ab  12.2Ac  17.9Aab | 13.5Ab  16.0Abc  15.7Ab | 20.4Aab  17.6Ab  19.1Aab | 28.2Aa  28.3Aa  20.9Aab | 1.95 | 0.0016 |
|  | **Ash (%)** | | | | | |  | |
| 1  2  3 | 12.0Aa  8.93Ba  8.68Ba | 11.0Aa  8.51ABa  7.61Ba | 8.87Aa  8.89Aa  7.49Aa | 11.5Aa  10.11Aa  9.41Aa | 11.1Aa  9.08ABa  6.94Ba | 9.31Aa  9.45Aa  9.23Aa | 0.615 | 0.0296 |

1Harvest 1 = 07/16/2015; Harvest 2 = 07/23/2015; Harvest 3 = 07/30/2015; 2SEM = standard error of the mean.

A-C a-d Means with different uppercase letters within a column and lowercase letters within a row differ at 5% significance by the Tukey test.

**Table 3.** Means for forage biomass production, and nutritional composition of annual forage crops under three harvestings schedule during the fall 2015

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Harvest1** | **Alternative forage crops** | | | | | | | | | | | | | | | **SEM2** | | ***P*- value** | | |
| **Forage Radish** | | | **Oats** | | **Canola** | | **Wheat** | | **Triticale** | | **Sunn hemp** | | | |
|  | | | **Forage biomass** | | | | | | | | | | | |  | | | | | |
| 1  2  3 | | | 1,688A  1,898Abc  1,851Abc | | 1,393B  2,643Aab  3,152Aa | | 1,729  2,218abc  2,064ab | | 1,596  3,234a  3,076a | | 862.4  2,115abc  2417.5ab | | 1031.3  1280.8c  694.4c | | 230.1 | | | | < 0.0001 | |
|  | | **Crude protein (%)** | | | | | | | | | | | |  | | |  | | |
| 1  2  3 | 15.5Ab  12.0Ba  13.2ABab | | | 17.5Ab  12.7Ba  8.60Cc | | 18.8Aab  12.0Ba  12.8Bab | | 18.2Ab  10.8Ba  9.50Bc | | 21.5Aa  13.4Ba  10.3Cbc | | 16.6Ab  11.6Ba  13.6Ba | | | | 0.59 | | < 0.0001 | | |
|  | **Acid detergent fiber (%)** | | | | | | | | | | | | | | |
| 1  2  3 | 19.6Ac  20.3Ab  21.9Ab | | | 29.9Aa  31.8Aa  28.2Aab | | 20.7Abc  18.3ABb  12.5Bc | | 30.6Aa  35.8Aa  33.7Aa | | 28.2Aa  31.7Aa  31.8Aa | | 28.1Aab  32.8Aa  35.2Aa | | | | 1.42 | | 0.0015 | | |
|  | **Neutral detergent fiber (%)** | | | | | | | | | | | | | | |  | |  | | |
| 1  2  3 | 21.8Bc  23.7ABd  26.6Ac | | | 48.6Aa  48.0Ab  44.8Ab | | 22.2Ac  23.0Ad  18.8Ad | | 54.4Aa  58.1Aa  55.7Aa | | 50.8Aa  53.3Aab  51.4Aab | | 34.2Bb  38.3Bc  48.6Aab | | | | 1.46 | | < 0.0001 | | |
|  | **Non-fiber carbohydrates (%)** | | | | | | | | | | | | | | |  | |  | | |
| 1  2  3 | 40.9ABa  43.5Aab  38.7Bb | | | 16.1Bb  25.0Bc  36.8Ab | | 37.0Ba  49.8Aa  53.1Aa | | 13.2Bb  21.2ABc  26.5Ac | | 11.4Bb  21.3Ac  28.8Abc | | 36.7ABa  40.1Ab  31.1Bbc | | | | 1.69 | | < 0.0001 | | |
|  | **Ash (%)** | | | | | | | | | | | | | | |  | |  | | |
| 1  2  3 | 17.5Aa  17.4Aa  18.3Aa | | | 12.9Ab  10.7Bb  7.52Cc | | 13.3Ab  10.8Bb  10.5Bb | | 9.82Acd  7.33Bc  6.16Bcd | | 11.4Abc  8.93Bbc  6.83Ccd | | 9.05Ad  7.73Ac  5.13Bd | | | | 0.42 | | < 0.0001 | | |

1Harvest 1 = 10/02/2015; harvest 2 = 10/19/2015; harvest 3 = 11/04/2015; 2SEM = standard error of the mean

A-C a-dMeans with different uppercase letters within a column and lowercase letters within a row differ at 5% significance by the Tukey test