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DEVELOPMENT OF AN INDEX TO RANK RYEGRASS VARIETIES FOR MILK PRODUCTION OR BEEF GAINS POTENTIAL

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ABSTRACT

The objective of this study is to develop a ryegrass forage value index (FVI) in Oregon. Twenty perennial ryegrasses were planted in the fall of 2015 in replicated plots of three complete randomized mixed blocks. Plots were harvested six times annually for two years and sent to Dairy One (Ithaca, NY) for analysis. Varieties were ranked for estimated milk production using an index based on energy (NEl). Estimated milk production per acre ranged from 284 cwt. to 241 cwt. for the varieties tested. This 43 cwt. difference could be estimated to be potentially worth from $600-$800 dollars and acre difference in total milk produced.

INTRODUCTION

The grass seed industry has had difficulty explaining the economic merit or value of an individual grass cultivar to the livestock industry. Often producers renovate pastures based on seed availability and perceived adaptability with no real appreciation for the genetic selection, testing and breeding efforts that went into developing that cultivar.
In both the beef and dairy industries, livestock breeders have become used to using bull proofs to identify individual bull proofs based off an index system (AIPL, 2012). A similar ryegrass index process has also been successful in New Zealand and in Ireland. However, interest in developing a process for creating a forage value index (FVI) for individual grass cultivars is beginning to gain interest around the world. At this time, there is not a FVI in place in the United States.

In Ireland, researchers developed a program to develop an economic ranking index for Irish perennial ryegrasses (McEvoy, 2011). The economically important traits selected in their system were spring, midseason and autumn grass DM yield, grass quality, and sward persistency. Like all indexes, each parameter in the index had a different weight based on economic importance.

In New Zealand, researchers have developed an economically based FVI that ranks cultivars according to their overall value to a dairy farm business. This FVI attempts to take into account all the major plant traits that drive the productivity of the dairy farms (Chapman et al., 2016). There are substantial regional differences in New Zealand. This project looked specifically at genotype x environment interactions and used to delineate performance differences in four major regions throughout the country.

According to a New Zealand National Forage Variety Trial data, since 1991, the trend for genetic gain in perennial ryegrass has been greatest for summer pasture production (+24lbs DM/acre/year), followed by autumn (+18 lbs. DM/acre/year), winter and late spring (both at +5 lbs. DM/acre/year). Genetic gains in total production of 50-55 lbs. DM/acre/year, or 1,000 lbs. DM/acre since 1990 (Chapman et al., 2011).

The objective of this study is to develop an FVI for grass cultivar ranking in Oregon. Quality measurements weighted for energy is the driver of this index as energy is the single most limiting factor for milk production or growth in high quality ryegrass pastures. Energy from pasture is the result the digestion of soluble and structural carbohydrates, proteins, starch and fats. Net energy for lactation (NEl) is the estimated feed energy available for maintenance and milk production after digestive and metabolic losses. Included in the objectives of this project is to estimate milk production and beef gain potential differences between the tested cultivars on a per acre basis.

MATERIALS AND METHODS

Twenty ryegrasses were planted in the fall of 2015 in a completely randomized block design with three replicate plots measuring 4 ft. by 10 ft. The seed was donated by participating grass seed companies. All plots were fertilized with 300 lbs of N as urea annually both years. All sixty plots were harvested six times annually for two years with a Swift Current forage harvester (Swift Current, Saskatchewan). All individual yield measurements were recorded for each plot and extrapolated into estimated DM per acre and sub-samples of each replicate were analyzed for forage quality at Dairy One lab in Ithaca, NY. Data were analyzed using an analysis of variance (ANOVA) procedure in Genstat. A FVI was developed to rank individual varieties and estimate milk production potential and beef gain potential per acre. Energy from pasture is the result the digestion of soluble and structural carbohydrates, proteins, starch and fats. Net energy for lactation (NEL) is the estimated feed energy available for maintenance and milk production after digestive and metabolic losses. The index used for this project combined the total pounds of DM per acre times the NEL or total calories per lb. By multiplying these two values, we created the FVI of total calories per acre produced annually. Calories per acre harvested were then used to determine the theoretical milk production and/or lbs of gain for a beef operation based off book values reported in the literature.

RESULTS

Forage ryegrass plots were grown, harvested and analyzed six times a year over a two-year period. Table 1 and Table 2 show a listing of all twenty varieties in the study and DM production for each cultivar for the first and second year of the project. The cumulative DM production for each cultivar over all six cuttings through the growing season is totalled in the far right column. In year 1, the variety Trojan had the highest DM yield all of twenty varieties tested at 15,085 lbs DM per acre (Table 1). In the same year, the lowest production variety was Oroverde at 12,503 lbs. DM per acre. No significant differences were observed in DM yield this first year. In year 2, the highest DM producer was Alto AR37 at 17,393 and the lowest in year two was Albion at 14,340 lbs. DM per acre (Table 2).

Energy animals derive from pasture is a combination of calories from soluble and structural carbohydrates, proteins, starch and fats. Net energy of lactation (NEL) accounts for all these and is the estimated feed energy available for maintenance and milk production after digestive and metabolic losses. A cow's total energy requirement will be the sum of what she needs for each function: maintenance, growth and production. For example, a cow weighing 1300 lbs (590 kg) making 100 lbs (45.5 kg) of milk containing 3.5% milkfat will require 9.57 Mcal per day for maintenance and 31 Mcal per day for milk production. The cow's total NEL requirement would be 40.57 Mcal per day or 0.78 Mcal per lb of DM if she consumed 52 lbs of DM per day (Ondarza, 2000). With these assumptions, we can estimate how many Mcals per acre we have grown by a variety and estimate the amount of milk potentially produced per acre (100 lbs of milk is also called a cwt). With a similar approach, we can estimate the energy needs for gains on a steer and figure out approximately how many pounds of beef could be gained if we had a known quantity of energy. Table 3 shows the FVI for both growing seasons combined, the relative value compared to the others in the study, an estimated number of cwts of milk per acre and estimated lbs beef gained for an intensive grazing beef operation. Projected milk production and potential beef gains are also shown in Table 3. These values demonstrate major differences in expected performance with both milking cows and/or beef animals grazing these varieties.

Table 1. Dry matter yields (lbs per acre) per cutting for six cuttings and total dry matter yield for year 1. No significant differences were observed this year.

	1	2	3	4	5	6	Total
Trojan	2544	1551	2660	2827	2891	2613	15085
TrojanNEA2	2301	1977	2590	2803	2920	2194	14786
Aberzest	2334	1851	2641	2424	2617	2567	14434
Alto	2687	1851	2641	2424	2617	2567	14357
Aberstar	2328	1727	1972	2860	2498	2931	14316
Elgon	2664	2014	2403	2636	2373	1986	14076
Remington	1880	1793	2245	2572	2615	2293	13964
Dromora	2142	1770	1976	2350	3131	2580	13950
BealeyNEA2	2208	1500	2661	2558	2840	2308	13906
Dunlace	2648	1785	2160	2581	2268	2350	13792
Albion	2573	1759	2186	2302	2752	2130	13702
Bealey	2230	1564	2245	2572	2615	2293	13519
Drumbo	2232	1490	2432	2252	2928	2148	13482
Polim	2245	1934	2281	2451	2463	2068	13441
Calibra	2428	1551	2523	2469	2175	2179	13326
Tyrella	2134	1621	2542	2162	2997	2001	13326
AltoAR37	2117	1621	2542	2162	2997	2001	13304
Kentaur	2282	1384	2285	2611	2254	2060	12625
Tetragain	2147	1274	2287	2728	2207	1982	12625
Oroverde	2335	1314	2455	2233	2574	1592	12503

Table 2. Dry matter yields (lbs per acre) per cutting for six cuttings and total dry matter yield for year 2. Varieties with different letters noted are statistically different (P<0.05).

	1	2	3	4	5	6	Total
AltoAR37	3323	2767	3088	3354	2764	2097	17393 e

Aberzest	3148	3344	3078	3105	2385	2176	17237de
Trojan	3484	2368	3619	2475	2901	2296	17143 de
Alto	3252	2911	3363	3181	2490	1916	17113 de
Aberstar	3186	2453	3103	3508	2697	2128	17075 de
BealeyNEA2	3318	3012	3479	2674	2378	1998	16859 cde
TrojanNEA2	3068	2726	2909	3305	2737	1966	16711 bcde
Calibra	3010	3283	3534	2278	2031	1897	16032 abcde
Elgon	3170	2746	3163	2556	2437	1926	15969 abcde
Remington	2688	3036	2997	2758	2443	2049	15970 abcde
Dromora	2971	2801	2966	2806	2612	1812	15667 abcde
Bealey	3096	2635	3202	2574	2330	1830	15667 abcde
Polim	2998	2632	2977	2698	2188	1906	15399 abcd
Kentaur	3417	3142	2975	2303	1642	1857	15337 abcd
Drumbo	2895	2959	2504	2773	1976	1937	15045 abc
Dunlace	2539	2505	3282	2335	2699	1618	14978 ab
Tetragain	3380	2788	3015	1863	2183	1684	14913 ab
Oroverde	3224	2944	2450	2431	1608	1608	14712 a
Tyrella	2579	2608	2466	2550	2177	2295	14677 a
Albion	3436	2291	2318	2318	2234	1779	14340 a

Table 3. Perennial ryegrasses ranked for milk production index, relative value, cwt milk per acre, lbs gain potential per acre. Varieties with different letters noted are statistically different (P<0.05). Milk production estimates based off the assumption of a Holstein cow producing 100lbs a day (40mcal). Weight gain estimates based off a 750 lb steer gaining 3 lbs a day (11mcal).

	Index Value	Relative Value	Milk - Cwts/acre	lbs. gain/acre	
Aberzest	11384	108	284	1034	f
Aberstar	11301	107	282	1027	ef
Trojan	11221	106	280	1020	ef
TrojanNEA2	10959	104	274	996	def
Alto	10909	104	272	991	def
BealeyNEA2	10876	103	272	989	def
Remington	10784	103	270	980	cdef
Dromora	10743	102	269	977	cdef
Elgon	10663	101	266	969	cdef
Calibra	10655	101	266	969	bcdef
AltoAR37	10480	100	262	952	abcdef
Polim	10305	98	258	936	abcde
Dunlace	10268	97	257	933	abcde
Bealey	10249	97	256	931	abcde
Drumbo	10143	96	253	922	abcd
Kentaur	10143	96	253	920	abcd
Albion	10008	95	250	909	abcd
Tyrella	9887	94	247	891	abc
Oroverde	9803	93	245	891	ab
Tetragain	9660	92	241	878	a

CONCLUSIONS

Ryegrass variety trials specifically looking at expected animal performance are limited in the US. Chapman (2016) has clearly indicated in New Zealand the challenges with environment x genotype interactions that may change the way one cultivar performs in a specific environment compared to others. This ryegrass performance data has clearly shown many ryegrass cultivars from around the world perform well on the Oregon coast. However, differences in performance were identified.

Net energy is usually the limiting factor in determining milk production performance of ryegrass pastures. Accounting for energy derived from the digestion of fats, proteins, soluble carbohydrates, starches and structural fiber is the most reasonable way to estimate performance per acre of these cultivars. Estimated milk production per acre ranged from 284 cwt. to 241 cwt. for the varieties tested. This 43 cwt. difference or range could be estimated to be worth from $600-$800 dollars per acre difference in total milk produced potentially (for milk valued at $15-$20 per cwt.). The potential gains per acre for a 750 lb. steer gaining 3 lbs. a day was also estimated (Table 3). Our top three varieties were estimated to produce over 1000 lbs. of gain per acre per year and the range from the highest to the lowest was over 150 lbs.

The varieties included in this trial are all modern varieties being developed by our grass seed industry. Clearly, this makes us wonder how these improved varieties perform compared to older unimproved varieties. The livestock industry has needed a way to rank varieties for potential animal performance for years. This work clearly demonstrates the production potential for using modern cultivars in your grazing and silage systems. These genetic differences appear to have major performance implications for grazing beef or dairy operations.

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