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Maize (Zea mays L.) Genotype Selection with Ability to Production Lignocellulosic Bioenergy and Grain Yield

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Abstract Text: Stover maize (*Zea mays* L.) can be converted into fermentable sugars to produce ethanol by similar processes they are subjected forage in rumen. The efficiency of these processes depends on the stover cell wall structure. Some authors have suggested that selection for grain yield and resistance to stalk lodging could reduce forage quality, and as a result, it potential ability to produce ethanol from stover. Others authors found evidence that would increase stover yield by selected genotypes with more plant height, stalk size and density, leaf area, and delayed senescence. Therefore it is important to find sources of genetic variability for silage production and lignocellulosic bioethanol without compromising grain yield. During the years 2012, 2013 and 2014, 144 genetically divergent genotypes were evaluated, including landraces (100 of them below to INTA Pergamino), commercial hybrids (12 from 10 seed companies), synthetic composites (10 of them below to DAS company), and experimental hybrids (22 from 3 seed companies), with different improvement level, cycle length, grain type, and genotypes with bmr genes. DK72-10VT3P (grain type, temperate germplasm), DK390VT3P (grain type, tropical germplasm) and BMR126HX (bmr, temperate germplasm) hybrids were included as checks in an augmented block design. The experimental unit consisted of 2 rows of 4 m × 0.5 m with a density of 80,000 plants ha^{-1} at harvest time. The harvest was made at physiological post-maturity. Agronomical performance was evaluated on Stover Dry Matter (SDMY, kg DM ha^{-1}), Grain Yield (GY, kg ha^{-1}); Stalk broken (SB), and Lodging (SL) and nutritional variables estimated by NIRS calibration: Neutral detergent fiber (NDF, %), Acid detergent fiber (ADF, %), and Acid detergent lignin (ADL, %). Two combined traits were calculated: Cellulose (CEL, %), as NDF-ADL; and Hemicellulose (HCEL, %) as FDN-FDA. Due to the dual propose (Stover and grain), selection indexes (SI) for each genotype and year were constructed using a nonparametric rank-sum index (Kang, 1988) that gave equal weights to high CEL, HCEL, SDMY, GY, and low ADL, SB, and SL. A SI Total (TSI) was calculated by the sum of the SI for each environment. As consequence, indexes allowed to identify the superior genotypes for both, their bio-energetic potential and stability. The ranking of the total sum of the indices grouped the best 15 genotypes (10% of the population), represented by six synthetic compounds (4 for silage and 2 tropical), 3 forage experimental hybrids, 4 landraces and 2 commercial hybrids. All selected genotypes were late-maturity cycle and tend to produce more biomass, both vegetative as reproductive. In contrast, the lower index group (11 landraces and 4 experimental hybrids) included early-maturity and no-breeding genotypes. Commercial hybrids demonstrated the highest stability across the year. The 4 selected landraces could be incorporated into breeding programs to obtain genotypes with the dual ability, bio-energ