Forage Research Updates

NORTH DAKOTA - Biomass Round Bales Aggregation Logistics C. Igathinathane, Cole Gustafson, Deepak Keshwani, Les Backer, Ken Hellevang, and Tim Faller, North Dakota State University; David Archer, Marty Schmer, John Hendrickson, and Scott Kronberg, USDA-ARS

iomass bales often need to be aggregated (collected into groups and transported) to a field-edge stack or temporary storage before utilization. Given the dispersed layout of the bales and the various options for equipment and collection strategies, it can be difficult to choose the best bale aggregation strategy. Several logistic scenarios involving equipment and aggregation strategies were modeled based on collection distances and evaluated. Application of a single-bale loader that aggregated bales individually was considered the "control" scenario with which others were compared. A computer simulation program was developed to determine bale coordinates in ideal and random layouts that evaluated aggregation scenarios. Simulation results exhibited a "diamond pattern" of bales on ideal layout and a "random pattern" when 10% variation was introduced. Statistical analysis revealed the effect of field shape, swath width, biomass yield, and randomness on bale layout did not affect aggregation logistics, whereas area and number of bales handled had significant effects. Number of bales handled in the direct method significantly influenced efficiency. Self-loading bale pickers with minimum distance path (MDP, 80% reduction from control) collecting the nearest bales and parallel transport of loader and truck with MDP (78%) ranked the highest; single-bale central grouping ranked the lowest (29%) among 19 methods studied. The MDP was found significantly more efficient (4%-16%) than the baler path. Simplistic methods, namely a direct triple-bale loader with MDP (64%-66%) or a loader and truck handling six bales running parallel with MDP (75%-82%) were highly efficient. Great savings on cumulative distances that directly influence time, fuel, and cost were realized when the number of bales handled was increased or additional equipment was utilized.