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Quantity of Nitrogen Fixed

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Legumes, in association with the bacteria that colonize nodules on their roots, can fix appreciable quantities of nitrogen (N). The legume species differ substantially in the amount of N that they will fix (Table 1). In addition to species differences, the amount of N that is fixed also depends upon the rate of plant growth, total forage yield, length of the growing season, and methods of grazing or harvesting.

Since N-fixation requires so much energy from the plant, it is critical that the plant is able to maintain a rapid growth rate. Nitrogen fixation will be drastically reduced by factors that slow crop growth and seasonal yield totals (e.g., drought, water-logged soils, unfavorable temperatures, low light conditions/shading, low soil fertility, low soil pH, competition from weeds or other plants, insect damage, disease, etc.).

The growing season of the legume also impacts the amount of N that is fixed. Legumes with a long growing season, such as alfalfa, will typically fix more N than annual legumes that have a shorter growing season and produce less total forage.

Nitrogen fixation is also affected by grazing and harvesting methods. Almost immediately after legumes are defoliated (either by grazing or mowing), N-fixation will decrease by 60 – 95%. Furthermore, research has shown that it may take 5 – 24 days for N-fixation rates to fully recover. The time it takes to recover, however, depends on how much of the legume was cut (i.e., how severe the defoliation was), the legume species, and the growing conditions. When legume stands are continuously overgrazed or in pastures that are not given adequate time to recover, these legumes may be adding very little (if any) N to the forage system. Thus, legumes must be given time to recover from defoliation if N-fixation is desired.

Table 1. Estimated range in nitrogen fixing potential of several legume crop species.[†]

Legume Species	Amount of Nitrogen Fixed[‡]
	(lbs of N/acre)
Alfalfa	50 - 300
Arrowleaf clover	50 - 180
Ball clover	50 - 125
Berseem clover	50 - 250
Birdsfoot trefoil	30 - 200
Crimson clover	30 - 150
Lespedezas, annual	30 - 120
Lespedeza, sericea	40 - 100
Lupin	50 - 150
Medics, annual	50 - 150
Perennial peanut	50 - 250
Red clover	50 - 250
Rose clover	50 - 125
Subterranean clover	25 - 175
Vetch, Hairy	50 - 150
White clover	30 - 250
Winter peas	20 - 90

[†] Adapted from Johnson et al., 1997; Havlin et al., 1999; Ball et al., 2007.

[‡] The lower end of this range in nitrogen fixation is expected when the legume species makes up approximately 25% of the stand. The upper end of this range should only be expected in pure stands under excellent growing conditions.

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