 International Journal of Agricultural Sciences, Vol. 5 Issue 1, January to May, 2009 : 311-313

Role of fodder legumes in livestock production

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Key words : Inoculation, *Azospirillum*, *Azotobacter*, Growth attributes, Yield attributes, Economics.

Importance and role of legumes in pasture improvement :

The chief objective of including legumes in the pasture is to increase livestock production which have no direct connection with nitrogen fixation. It is more likely to be a function of feeding value of the legume forage. Through selective grazing quite a small quantity of legume in the pasture can markedly improve the nutrition of live stock at critical times of the year (Christian and SHAW, 1952).

The functions of symbiotic nitrogen fixation by pasture legume can be summarized as follows:

The ability to fix nitrogen from the air gives the legumes a competitive advantage in association with grasses and weeds.

The presence of the legume in the forage provides a better diet for a livestock, because legumes in general have relatively high feeding value specifically because modulated legumes can maintain a high nitrogen concentration than grasses particularly in mature forage. Nodulated legumes do not show the rapid dilution of plant nitrogen concentration that occurs when unnodulated legume and non legumes are given with a limited nitrogen supply.

The legume contributes available nitrogen to non legume in the sward.

The legume contributes nitrogen that may be useful during a subsequent period of arable farming.

Morphology of legumes :

Fodder legumes belong to the family legurninosae.

Desmodiurn intortum (green leaf):

Large trailing and climbing perennial roots at the nodes and has a deep tap root, long pubescent stems branch freely and are often reddish brown. Had shorter internodes than desmodium uncinaturn and is leafier. Leaves usually have reddish brown to purple flecking on the upper surface. Leaflets 2-7 cm long and 1.5-5.5 cm broad with a length width ratio of 1.4 to 1 are shorter and more rounded than desmodium uncinaturn. Terminal raceme pact, reserves to the main rachis, adheres to animals and to clothing but not as tenaciously as that of desmodiurn uncinaturn (Barnard, 1967)

Centrosema pubescence (Centro):

Vigorous, training, twining and climbing perennial herbs in pure stands forms a compact dense cover 40 to 45 cm, high in 4 to 8 months from sowing. Very leafly; the slightly hairy stems do not become woody for at least 18 months. Leaves trifoliate leaflets dark green ellipse are ovate elliptic, obtuse or shortly obtusely acuminate, about 4 x 3.5 cm. Slightly hairy, especially on the lower surface stipules long persistent. Flowers large and showy born in axillary racemes. Each flower has two striate bracteoles. Flowers bright or palelilac on either side of a median greenish yellow hand with numerous dark violet strips or blotches. Pod linear with prominent margins 7.5 to 15 cm long flat, thick, straight or slightly twisted acuminate, dark brown when ripe containing up to 20 seeds septa between seeds. Seeds shortly oblong to squarish with rounded comers 4 to 5 x 3 to 4 mm brownish black mottled darker blotches with lighten coloured halo.

Desmanthus virgatus* (L.)*:

Prostrate, decumbent or erect herbaceous perennial shrub, typically to 0.7 m, occasionally to 1.5 m tall; strongly branched from the base, with a taproot to 0.5 m depth and 1 – 2 cm in diameter young stems green and hairless (or with sparse white hairs), angular with golden corky ridges. Older stems hairless, shiny red or brown. Bipinnate leaf 2.4 – 8.0 cm long, with 2 – 5 pairs of pinnae 11-30 mm long and 11-23 pairs of leaflets/ pinnae, 2.4-7.0 mm long and 0.7 – 1.6 mm wide.

Persistent stipules 2-9 mm long. Small flowering heads (condensed spikes) 0.5-0.9 cm long, occur singly in leaf axis on short peduncles (to 4.0 cm long). Heads contain 3-22 flowers that may be perfect, functionally male or sterile. Sterile flowers 0-8 occur at the base of the head. Male flowers usually absent, occasionally 1, occur towards the base of the head above the sterile flowers, but below the perfect flowers. Perfect flowers

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3-14 occur epically. Fruiting stalks 1.0 – 5.2 cm long bear 1-11 pods. Pods are linear, 5.5-8.5 cm long and 3.2-4.9 mm wide, opening along both margins. Reddish – brown to nearly black at maturity. Seeds 11-26/pod, 2.4-3.1 x 1.7-2.4mm, flattened and ovate in shape and reddish-brown or golden – brown in colour.

Grass legume mixture :

The large increase in animal production which are achievable through incorporation of improved legume cultivar of good persistence after the best prospect for low-cost grass land production systems in many temperate and tropical regions. The selected varieties of *stylo-santhes gulanensis*, *Stylo hamata* and *Stylo seabra* have provided the basis of viable production system in many tropical countries.

It is common for the leaves of *Stylosanthes* spp. to provide forage with more than 2% nitrogen and to be 60% digestible (MC Ivor, 1979).

The nodulation of legumes :

The life of a nodule in herbaceous species is usually short the longevity and size being a function of the *Rhizobium* strain and the host plant. The total nodule volume per plant is constant, irrespective of the virulence of the *Rhizobium*, but differs with different strains or lines of the plant host.

The time taken for the appearance of first nodule differs with species of legume. Gates *et al*. (1966) recorded in the laboratory initial nodulafion in Stylosanthes humilis is on day 17 from planting, active nodules on day 23, and active fixation on day 26. Oke (1967) reported that centrosema pubescence nodulated towards after germination and *Cajanus cajan* and *S. guyanensis* in three weeks.

Nodules occur on luceme plants in the field about the twenty third in day after seed inoculation and on white colour about the eleventh day. The quantity of atmospheric co-nitrogen fixed by legumes varies with the type of legume host and *Rhizobium* strain which lives in symbiosis with it. The amount of fixation is closely related to the volume of Rhizibium containing tissue in the nodule and the duration of life of this tissue. Nitrogen fixation is then closely related to nodule structure, size of plant will also have an effect.

The presence of haemoglobin in root nodule is necessary for nitrogen fixation. Nodules formed by ineffective strains are while in cross section and do not contain haemoglobin. The red pigment of haemoglobin in effective nodules gradually changes to green as the bacterial tissue ages and nitrogen fixation ceases.

Rhizobium :

Rhizobium is most important for growth and productivity of legumes. Therefore arrangements have to be organized that the necessary Rhizobiurn for the different legume species are available and used for inoculation of the seed before sowing. Instruction on inoculation and handling inoculated seeds are essential. Cow pea-Rhizobiurn is effective on most of the legumes used in Kerala (*Sylosanthes guianensis*, *Macrotyloma axillaris*, *Lablab purpureus*.

Nitrogen fixation in legumes :

The aim of legume introduction must be concentrated on the provision of a higher quality feed to give better animal performance. Tropical pasture legumes fix as much nitrogen as temperate legumes. Centrosema/*Cynodon poleclastochyus* pastures in Nigeria fixed an estimated 280 Kg nitrogen/ha/annum. Kenya *Glycine wightie* added 180 kg nitrogen/ha/annum in the next four years. *Centrosema pubescence* added 225 Kg nitrogen/ha in five months growth in West Malaysia.

Weather effect on nitrogen fixation :

The amount of nitrogen fixation increases with the amount of legume growth. It follows that weather conditions which give high legume yields promote more nitrogen fixation, In dry environment much less nitrogen fixation is possible.

Effect of mineral nutrition on nitrogen fixation :

Special attention should be given to the nutrients specifically involved in nitrogen fixation, molybdenum, iron and cobalt and to the nutrients which particularly favour legume growth such as phosphorus, potassium, sulphur and calcium.

Nitrogen fixation is most efficient on soils low in nitrogen but on which all other nutrient deficiencies are corrected. In pure legume or legume dominant, swards, nitrogen fixation is reduced under condition of good soil nitrogen supply and the legume takes up available nitrogen from the soil rather than fix nitrogen from the atmosphere.

Management effects on nitrogen fixation and transfer:

Nodules are the organs of the plant first affected by carbohydrate shortage induced by grazing or cutting. Heavy pasture use reduces the size which nodules attain and the number of new nodules being initiated. Drastic defoliation can cause the premature senescence of nodules and their shedding from roots. Root growth is next most sensitive, this is followed by inflorescence and stem growth with leaf growth least affected. On the other hand, the most effective mechanism of transfer of nitrogen from legume to grass is via the grazing animal consuming legume shoots and voiding most of the nitrogen in relatively available forms. A balance, therefore, has to be found between defoliation which will not imperil legume growth and nitrogen fixation too greatly and defoliation which will transfer nitrogen to companion grass. This problem is less evident for low growing legumes eg. *Stylo humilis* which is most resistant to heavy grazing and which benefit from the consumption of taller companion grasses.

Most of the nitrogen fixed by legumes enters the shoots. Ibis proportion varies from 55 to 80 per cent, according to sevesity of defoliation. Some transfer of nitrogen from root decay is feasible, especially with annual species. The contribution caused directly by nodule decay or nodule nitrogen excretion is very small. Although the nitrogen concentration in active nodule tissue is high (often5-6per cent nitrogen) the proposition of nitrogen located in the nodules is rarely about 4 per cent of the total plant nitrogen. Nitrogen in the shoots is very slowly move to companion grasses. If this transfer is affected by normal process of senescence, plant erosion and decay. Passage through grazing animal is a much more effective process. Cut and remove management systems provide little opportunity for Nitrogen transfer of legumes to grass, since transfer is limited to under ground organs.

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Received : December, 2007; Accepted : November, 2008