

## **Mexican sunflower (*Tithonia diversifolia*) as a feed resource and a green manure for soil fertility improvement in smallholder dairy production systems**

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Mexican sunflower or Wild sunflower (*Tithonia diversifolia*) is a quick growing and soft shrub. It grows to a height of 1-3 metres and bears alternately positioned leaves along most of the stem. The flower of *Tithonia* is about 3 cm in diameter and has yellow petals.



*Tithonia diversifolia* plants

Mexican sunflower adapts to a wide range of conditions like low soil fertility. The shrub is found growing on abandoned/waste lands, along major roads and waterways and on cultivated farmlands in all districts of Uganda. Depending on the area Mexican sunflower may be either annual or perennial. The reported uses of Mexican sunflower include: fodder for ruminants, poultry and pig feed, fuelwood, compost, land demarcation and soil erosion control. In addition, extracts from Mexican sunflower plant parts reportedly protect crops from termites and contain chemicals that inhibit plant growth and control insects.

### **Establishment and management**

Mexican sunflower can be easily propagated by (a) direct seeding or (b) planting cuttings. Seeds can be sown directly or in containers. The best method is to make a furrow for the seeds and cover them lightly with sandy soil. Then apply mulch to prevent the seeds from being washed away and to retain the soil moisture. For successful propagation, cuttings should be 20-30 cm long from mature green stems. Plant the cuttings with 1 or 2 nodes below ground level and 2 or more nodes above. Place the cuttings in the ground slanting at an angle of 45-60 degrees using a spacing of 0.75 x 0.75 metre. Mexican sunflower is easy to grow and does not require fertilizer

or special attention. It tolerates regular heavy pruning. Avoid split cuttings, as they do not sprout.

The plant is an early colonizer at the start of rains and is capable of growing late into the dry season when most forages are no longer available due to drought. Mexican sunflower can be harvested approximately 3 months after transplanting. It tolerates regular heavy pruning. Post-flowering cuttings result in higher yields than pre-flowering cuttings. Annual biomass yields of 60 tonnes per hectare have been obtained at cutting intervals of 4 months.

### **Mexican sunflower as a protein supplement to dairy cows**

The major constraint to dairy cattle production in Uganda is the availability of cheap and quality feedstuffs, especially in periods of dry season. The increasingly expensive nature of most feed ingredients has resulted in reduced dairy cattle production activities by the ordinary peasant farmers who constitute the majority of dairy farmers, and this has impacted negatively on the available animal protein for human consumption.

Feed alone account for 60-80% of the total cost of any dairy cattle production system. Although, grasses are abundant in Uganda, seasonal changes in their palatability and nutritive values have been a major challenge in dairy cattle production. The desire of most dairy producers has been towards the search for mostly, cheaper feed ingredients that are readily available for the better part of the season and have no competition with man's dietary demands. This therefore necessitates the search for alternatives to conventional feed resources that have hitherto been regarded as "weeds" due to their poor or low utilization in the dairy cattle feed industry. Such alternative feed resources include Mexican sunflower. This plant has some attributes to qualify it as a cheaper substitute to conventional resources. It is abundant in nature, it has limited processing demand and it is not in competitive demand for human consumption.

#### **(a) Mexican Sunflower as a protein supplement source for dairy cows**

Mexican sunflower foliage is a valuable fodder for ruminants, due to its high protein content and relatively high digestibility and degradability. The average dry matter is 19.8 percent which means that 100 kgs of fresh Mexican sunflower contains approximately 19.8 kg of dry matter and 80.2 kg of water. A 500 kg dairy cow would require about 15 kg dry matter (intake is 3 percent of its body weight) and Mexican sunflower should comprise up to 30 percent of the daily intake therefore 30 percent of 15 kg is 4.5 kg dry matter. To provide 4.5 kg dry matter of Mexican sunflower you would require about 23 kg of fresh Mexican Sunflower leaves to be fed.

#### **(b) Mexican Sunflower leaf meal**

Mexican Sunflower foliage (leaves and tender shoots) can be collected from waste land at the sides of the highway or from established fields, chopped and dried in the sun for 3 to 5 days. It is then milled and packed into polythene bags and stored for use in feed formulations.



*Homemade dairy pellets comprising of Mexican sunflower leaf meal*

Mexican Sunflower leaf meal is a valuable supplement in dairy cattle diets. Mexican Sunflower leaf meal has about 18.9 percent crude protein. The leaf meal can be used in the production of dairy meal or dairy pellets. Mexican Sunflower dairy pellets or dairy meal may therefore be able to be used to provide the deficient nutrients in the crop residues and low-quality forage grasses. In a study conducted by the National Livestock Resources Research Institute (NaLIRRI), dairy pellet supplements based on sorghum stover and Mexican sunflower leaf hay resulted into between 10 and 16% increases in the average daily milk yield of dairy cows fed a basal diet of Guinea grass hay. These findings indicate the potential of Mexican sunflower leaf meal as a supplementary forage for dairy cattle fed low quality roughages.

### **(c) Ensiling Mexican sunflower with low quality forages**

Mexican sunflower is prepared by harvesting daily, the fresh and mature leaves of plants of different ages before flowering. The leaves are chopped into pieces of about 2-3 cm and ensiled in a plastic container using sugarcane molasses as the silage additive in a percentage of 4% to the total weight (wet basis) of the chopped leaves in the container. The plastic container holding the ensiled leaves of Mexican sunflower must be properly sealed and carefully closed to prevent any air contamination and kept in a safe environment to prevent physical damages or alterations. The ensiling process is carried out for a period of 21 days. The ensiled Mexican sunflower is used as a protein supplement to dairy cattle.

Mexican sunflower (30 percent) can also be ensiled with Napier grass or chopped maize stover to improve the quality of silage.

### **Anti-nutrients in Mexican sunflower**

Mexican sunflower has a number of anti-nutrients such as tannins. However, all major anti-nutrients in fresh Mexican sunflower leaves can gradually decrease with lengthening duration of ensiling or drying.

### **Mexican sunflower as a green manure and for soil fertility improvement**

Unused, non-traditional organic resources grow on or near smallholder farms. Some have relatively high nutrient concentrations, but little is known about their potential as

a nutrient source to improve soil fertility and crop yields. One such organic resource is the green biomass of Mexican sunflower. Green biomass of Mexican sunflower is undoubtedly a potential source of nitrogen (3.50 percent), phosphorus (0.37 percent) and potassium (4.10 percent) contents. It therefore has great potential for use as soil amendment. Mexican sunflower produces high biomass and is as effective biomass for mulching and increasing yield of crops. The abundance and adaptation of this shrub to various environment couples with its rapid growth rate and very high vegetative matter turn over makes it a candidate species for soil rejuvenation.

Addition of foliage (leaves and soft twigs) of Mexican sunflower to the cropping area leads to double the yield of the crops and that it is more effective than urea when applied at the same Nitrogen rate. To apply Mexican sunflower, cut leaves and soft twigs from the hedges, chop them into small pieces, and either place them in each planting hole or spread them evenly over the surface and then incorporate them into the soil. You can continue applying this green manure throughout the active growing period of the crop either by placing it along the rows of plants or by incorporating it into the soil. After you apply the leaves, they must be mixed well with the soil or left to decompose for at least one week before you plant.

The quantities of green biomass available from Mexican sunflower growing near to smallholder agricultural fields, however, will typically not be sufficient to supply all the nutrients required to eliminate nutrient deficiencies over large areas of the fields. The integration of Mexican sunflower biomass with mineral fertilizers is consequently essential to supply sufficient nutrients. The integration of Mexican sunflower and mineral fertilizers would have added advantages, as compared to sole use of mineral fertilizers, if Mexican sunflower enhanced the use efficiency of mineral fertilizers or provided non-nutritional benefits to crops.

The potential for Mexican sunflower to improve soil fertility improvement is greatest on small landholdings with nearby production of Mexican sunflower biomass and with ample, low-cost labour for cutting and carrying the biomass. The availability of labour and its cost relative to the value of crops are important considerations because the cutting and carrying of Mexican sunflower biomass are labour intensive. The importance of labour is further amplified by the bulkiness of green Mexican sunflower biomass due to its high-water content and the need to cut and carry it during a period of peak labour demand for land preparation and planting. The use of Mexican sunflower biomass is economically more attractive with high- than low-valued crops such as vegetables.