



# Tree lucerne: A tree useful for fodder and multiple products and services

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International Livestock Research Institute

Training of Trainers (ToT) Workshop  
Michew, Tigray, 19-21 April 2017



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# 1. Introduction

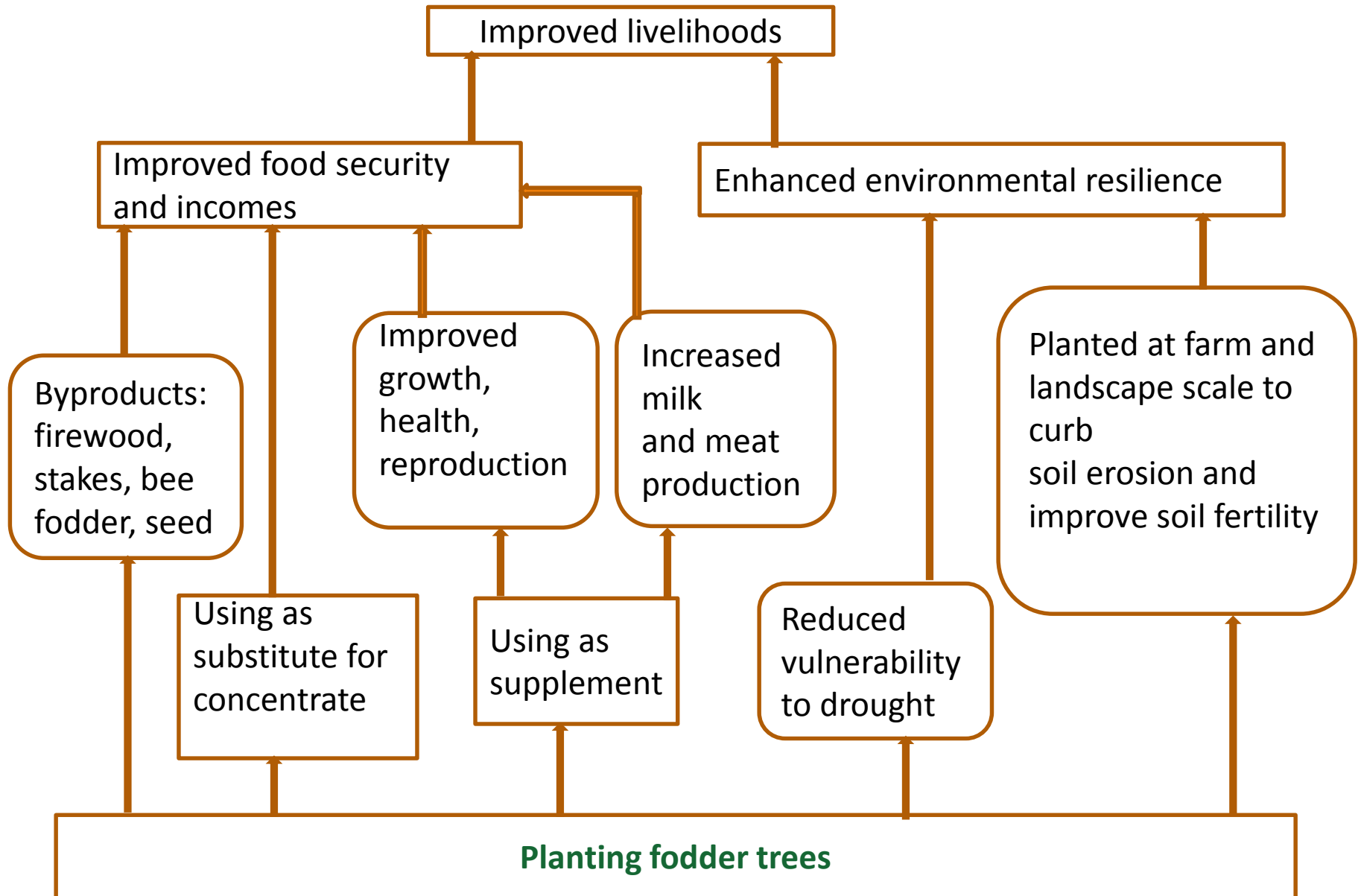
- Livestock are important components of the mixed crop-livestock systems
- Are considered as important pathways for rural households to escape poverty
- Their productivity is challenged by feed, health and breed related issues
- Africa RISING in the first phase included feed and forage as one of the seven research thematic areas
- Action research in Africa RISING sites focused mainly on fodder trees (tree lucerne), oat/vetch mixtures, sweet lupin, desho grass, faba bean/ forage intercropping, post harvest crop residue handling (feed troughs and sheds)

## 2. Why fodder trees?

- Climate change adaption: Trees and shrubs tap a larger volume of soil and access water to grow under dry periods. As a result, they provide green biomass for livestock at times of nutritional stress.
- Feed quality: Many trees and shrubs have high feeding quality in terms of protein and contents of some minerals. Example: Ca and P are more in trees and shrubs than grass pastures at comparable stages of growth. Deficiencies of these two minerals results in reproductive problems of ruminant animals

- Nutrient cycling: Most trees and shrubs are deep rooted and capture nutrients deposited below grass and forage roots. Some add nutrients through N-fixation and others recycle through scavenging.
- Management practices: Trees and shrubs tolerate wide range of management practices such as cutting, pruning, pollarding, thinning and lopping.
- Longevity: Life span of most trees and shrubs is more than grasses and shrubs. This has implication on cost of establishment and management.

- Multiple products and services:



### 3. Example of potential fodder trees and shrubs in the Ethiopian highlands

Potential trees and shrubs that are under farming in the highlands include:

Chamaecytisus palmensis	<i>Ficus thonningii</i>
Sesbania sesban	Cordia africana
Calliandra calothyrsus	Dombeya torrida
Leucaena pallida	Vernonia amygdalina
Cajanus cajan	Hagenia abyssinica
Acacia decurrens	Albizia gummifera
	Buddleja polystachya
	<i>Erythrina brucei</i>



## Tree Lucerne (*Chamaecytisus palmensis*)





## 4. Distribution and growing ecology of tree lucerne

- Commonly named as tree lucerne and tagasaste
- Native to Spain and exotic species to Australia, Ethiopia, South Africa, Rwanda and New Zealand
- Adaptable for use from 2000 to over 3000 masl of the Ethiopian highlands.
- It is one of the few fodder and fertilizer tree species that perform on high altitude areas and fix N that improve livestock, crop and soil productivity.
- Rainfall requirement is from 350-1600 mm
- Soil should be well drained

# 5. Tree lucerne action research in Africa RISING sites

- Research locations- 8 Africa RISING kebeles



- Research approach- 8 FRGs established. Each FRG consisted of 25 and more farmers

Table 1. Local names given to tree Lucerne farmer research groups and their translation in AR sites

Africa RISING sites	Africa RISING research Kebeles	Local name for the tree lucerne FRG	Meaning of the local name
Lemo	Jawe	<i>Adebo</i>	Milk provider
	Upper Gana	<i>Deesiso</i>	Source of milk
Sinana	Ilu- Sanbitu	<i>Anole</i>	More milk
	Salka	<i>Sokore</i>	A known local dairy cow breed name
Basona	Goshe Bado	Tekemkegn	Important in many aspects
	Gudo Beret	<i>Hulegeb</i>	Multi-purpose
Endamehoni	Tsibet	<i>Lemlem</i>	Ever green
	Emba Hasti	<i>Birhan Tseba</i>	The light of milk

- Seedling delivery- Each farmer participating in the research received on average 50 seedlings. A total of 253 farmers participated in the research.

## 6. Establishment of tree lucerne

- Identification of farmers who are interested to plant and use tree lucerne
- Care should be taken to be inclusive (gender)
- Sources of seed: local collection, seed suppliers such as Eiden seed company, Begashaw Addisu AF seed supplier
  - Amount of seeds per kg is 45,000
  - Seeds can be stored for 4–5 years
- Seedling raising: private, community and government nurseries
- Seedling production systems: bare rooted and container systems
- Seed treatment: Seeds of tree lucerne require seed treatment such as scarification or immersion in boiled water for a minute

- Compatibility of farmers' planting niches – observation
- A seedling size of more than 45 cm is preferable for planting
- It requires a minimum of 3 months in the nursery
- Time of planting should be in a cloudy day
- A planting hole of 30-40 cm deep is good not to harm tap roots
- It can be planted as live fence, fodder lot (block planting), SWC structures, boundary planting and intercropped with crops and vegetables.
- Planting space between trees can be 25 cm or more.

Table 2: Mean survival, height and RCD by region

Survival and growth	Amhara (N=48)	Oromia (N=41)	Tigray (N=38)	SNNPR (N=32)	P value
Survival after 9 months (%)	14.81	35.21	17.89	43.56	0.000
Height after 9 months (m)	0.361	1.235	0.461	0.659	0.021
RCD after 9 months (cm)	0.339	0.876	0.562	0.928	0.002

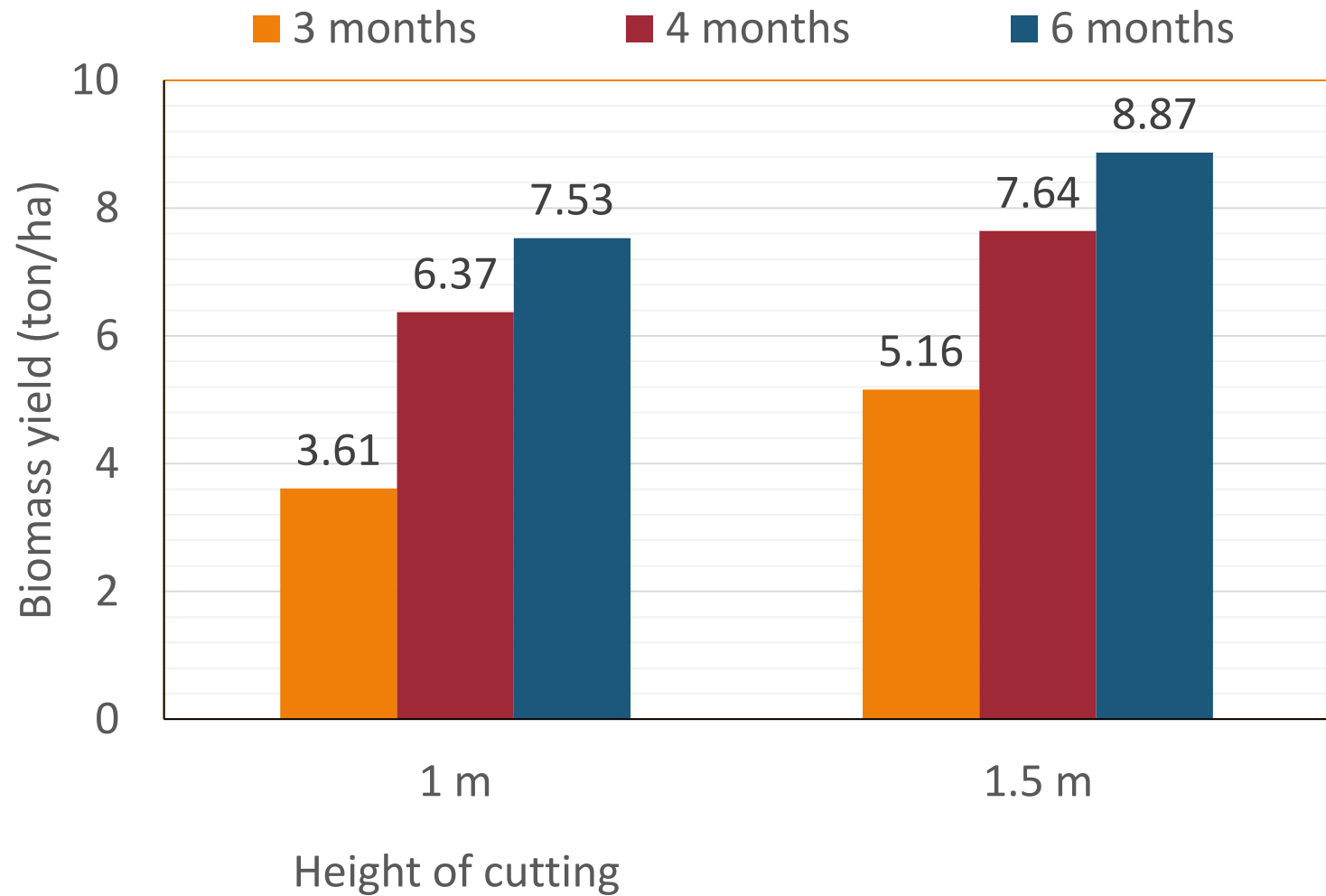
**Correlations:** survival and height correlation( $r$ ) is equal to 0.527 ( $p=0.000$ ); survival and RDC,  $r=0.786$  ( $p=0.000$ )

Table 3: Mean survival, height and RDC by niches				
Niche	Backyard	Outfield-terraces	Outfield-Irrigated land	P value
Survival after 9 months (%)	30.45	11.19	9.42	0.007
Height after 9 months (m)	0.771	0.221	0.337	0.189
RCD after 9 months (cm)	0.728	0.283	0.428	0.039



## 7. Management of tree lucerne

- Regularly spot weed around the seedling
- Protection against livestock trampling and browsing-  
Fencing
- Mulching/manure helps to retain moisture and suppress weeds
- Watering at early stage of the plant improves survival and growth
- Application of ash (termite)
- A cutting height of 1 m to 1.5 m provides good biomass.
- The plant can be harvested 2-3 times per year depending on the management.



Biomass yield of tree lucerne under different cutting height and interval after nine months of establishment in Africa RISING sites.

## 8. Utilization of tree lucerne

- Tree lucerne in well-managed farm fields can reach for the first harvest and use as animal feed within 9 months after planting.
- Tree lucerne can produce more than 4 -7 t ha<sup>-1</sup> dry biomass per year under farmers' management condition and when planted at 1 m X 1 m spacing.
- The leaf and edible branches of tree lucerne are very good sources of nutrients for ruminant livestock, containing high amounts of crude protein and (app 20-25%), and digestible organic matter ( $\geq 70\%$ ).
- The foliage of tree lucerne can be fed green or wilted and can be preserved in the form of hay and used as needed.

- Nutritionally, tree lucerne leaf is comparable to concentrate feeds. For smallholders whose access to concentrate feeds is limited can serve as a perfect substitute
- Supplementation of 1 kg of dried tree lucerne leaf to a lactating dairy cow can give up to 1.2 Lts of extra milk.
- Supplementation 300-400 g of tree lucerne hay to a fattening sheep is adequate to achieve a daily body weight gain of 70 grams, with a significant improvement in carcass dressing percentage (from about 40% in un-supplemented animals to about 48% in supplemented ones).
- In addition to the foliage, seeds of tree lucerne can serve as good sources of poultry feed.

- Pre- feeding treatments such as fresh foliage, wilted and dried foliage can have effect on palatability of tree lucerne by small ruminants and cattle.
- Sheep readily consumed and highly preferred the fresh tree lucerne, while cattle preferred the dried tree lucerne.
- Tree lucerne flower is also a preferred bee fodder to produce quality honey.
- Tree lucerne stems are good sources of farm implements and fire wood.

## 9. Challenges for tree lucerne farming



Challenge: Defoliation by worms (*Basona worena*)





Challenge: Poor follow up, weeding and site selection (Basona Worena)





Challenge: Unidentified disease or nutrient deficiency (Sinana)





Poor site selection and management practices of tree  
Lucerne farming - Basona



## 10. Good tree Lucerne farming practices



Well managed tree lucerne at Goshe Bado -Basona





Tree lucerne in a well-managed farm in Africa RISING Lemo site, SNNPR





Well managed tree lucerne by a woman farmer in Endamehoni  
Africa RISING site, Tigray





Tree lucerne and garlic intercropping in Sinana, Africa RISING site





Tree lucerne planted on soil structures in an Africa RISING watershed site at Lemo, SNNPR for various products and services





Tree lucerne flowers - a potential plant species for bee fodder  
(Endamehoni)





Farmers train branches of 2-3 years old tree lucerne to remove chaff or straw from the grain (Basona Worena)





Tree lucerne grown around homesteads for feed and other products and services at Salasfa village, Basona Worena





Temesgen Alene (Africa RISING site coordinator) demonstrates mix of tree lucerne and crop residues that a farmer feeds using feed trough at Salasfa village, Basona Worena

# 11. Scaling of tree lucerne

- Seed sources
- Seed system
- Identification of appropriate farm types and targets (dairy cows, fattening)
- Identification of the right ecologies – soils, climate, landscape
- Capacity building schemes on establishment, management and utilization of the plant species
- Partnership

## 12. Conclusion

Household size, access to reliable water supply, and management factors—including fencing planted seedlings to protect browsing, mulching during dry periods, clean spot weeding and applying organic fertilizers—significantly enhanced survival and growth of tree lucerne in the Africa RISING planting sites.



## Africa RISING CGIAR partners in Ethiopia







## Africa Rising's local partners in Ethiopia

- **Academic institutions:**
  - Wachemo, Mekelle, Madawolabu, Debre Berhan and Hawassa universities; Maichew Agricultural College
- **Regional research organizations:**
  - Amhara Regional Agricultural Research Institute, Southern Agricultural Research Institute, Tigray Agricultural Research Institute, Oromia Agricultural Research Institute
- **Federal research organizations:**
  - Ethiopian Institute for Agricultural Research, Ethiopian Health and Nutrition Research Institute
- **Offices of Agriculture:**
  - Endamekoni (Tigray), Basona Worena (Amhara), Lemo (SNNRP) and Sinana (Oromia)
- **Agricultural Transformation Agency**



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