

Note on Measures to be taken for Increasing Availability of Fodder

1. Availability of adequate quantity of feed and fodder for livestock is essential for improving livestock productivity. Under the Rashtriya Krishi Vikas Yojana (RKVY), the States have sufficient funds and autonomy to undertake development of feed and fodder besides other agricultural and allied activities. Government of India has also released funds under the Centrally Sponsored Scheme, and distributed 'Minikits' of high yielding fodder varieties to assist the States in their endeavor to augment the availability of quality feed and fodder. The Accelerated Fodder Development Programme (AFDP) launched in the financial year 2011-12 as a component of RKVY has also provided additional funds to the selected States. Further, as per the latest guidelines, MNREGS funds can also be utilized for improving availability of fodder.
2. Though the availability of feed and fodder has improved in the last decade, still there exists a substantial gap between the demand and availability of fodder in the country, particularly during the lean periods and at the time of natural calamities including droughts/floods. Following measures may be taken for ensuring maximum availability of fodder for sustaining livestock production:

Optimum utilization of land resources

3. India with above 2.3% of the land area of the world, is maintaining about 10.71% of the world's livestock. The availability, requirement and shortage of fodder as estimated by NABCONS in 2007 is as under:

(Dry matter in million tones)

S.No.	Type of fodder	Demand	Availability	Gap
1.	Dry Fodder	416	253	163 (40%)
2.	Green Fodder	222	143	79 (36%)
3.	Concentrate	53	23	30 (57%)

Source: NABCONS-2007.

4. The number of livestock is growing rapidly, but the grazing lands are gradually diminishing due to pressure on land for agricultural and non-agricultural uses. Most of the grazing lands have either been degraded or encroached upon restricting its availability for grazing. The area under fodder cultivation is limited to about 4% of the cropping area, and it has remained static for the last four decades. Owing to the importance of food crops and other cash crops, it is very unlikely that the area under fodder cultivation would increase substantially.

5. Therefore, the need of the time is to adopt the practice of land use with multiple crops in a sustainable manner. Adopting Silvi-pastoral and Horti-pastoral models suitable to the area can help in substantially enhancing the availability of forage for the livestock. About 29 Million Ha area in the country falls under the category of open forests with less than 0.4 canopy density which can be developed with fodder trees. This huge land resource can be utilized for growing fodder, not only as an under-storey on the partially shaded ground without affecting standing trees. Similar development is also possible in the area under horticulture orchards. While the forest department can undertake silvi-pastoral plantations through the Joint Forest Management Committees, the horti-pastoral activities can be initiated by incentivizing the farmers who are owners of the orchards.

Improving production by using high yielding fodder varieties

6. Use of quality fodder seeds including dual purpose grains like bajra, maize and jowar, etc., is essential for improving productivity. Some of the cultivated fodder species for different regions are indicated below (list is illustrative):

Type of Land	Rainfed	Irrigated
(a) Arid Tracts	Jowar, Bajra, Moth, Guar, Lobia	Lucerne, Berseem, Oats, Maize, Jowar, Bajra
(b) Semi-dry	Bajra, Jowar, Lobia, Moth, Guar, Velvet Bean, Field Bean, Moong	Jowar, Maize, Lobia, Teosinte, Lucerne, Berseem, Sarson, Turnips, Hybrid Napier, Oats, Sudan grass, Guinea grass, Setaria sphacelata, Rhodes
(c) Semi-wet	Dinanath Grass, Jowar, Lobia, Rice Bean, Velvet Bean, Teosinte, Sunnhemp	Berseem, Oats, Sudan grass, Hybrid Napier, Guar, Jowar, Maize, Para grass, Rhodes, Setaria
(d) Wet regions	Jowar, Dinanath, Rice Bean	Berseem, Oats, Hybrid Napier, Guinea, Lucerne, Berseem, Sarson, Turnips, Hybrid Napier, Oats, Setaria, Para grass, Jowar
(c) Lower hills	Jowar, Lobia, Bajra, Velvet Bean, Field Bean, Guar	Maize, Jowar, Oats, Berseem, Lucerne, Hybrid Napier, Sudan, Setaria, Rhodes

7. An illustrative list of trees, shrubs and grasses for development of pastures, suitable for different regions is enclosed in the **Annexure-I**.
8. Inadequate availability of quality fodder seeds is a major constraint. Fodder seed production is not remunerative in many of the fodder crops. State Governments may take initiatives to encourage farmers for taking up the production of high yielding varieties by providing sufficient incentives to farmers for production of fodder seeds of high yielding varieties by way of assured procurement with a remunerative price and assistance of inputs. State Governments can avail the benefit of the component of 'Fodder Seed Procurement and Distribution' under the 'Centrally Sponsored Fodder and Feed Development Scheme'. Provisions under AFDP can also be utilized for this purpose.
9. Following high yielding fodder varieties may be considered for seed production programme for improving fodder yield per hectare in respect of existing area under fodder:

S.No.	Name of the fodder crop	Name of varieties
1	Maize	African tall, J-1006, Vijay composite.
2	Sorghum	SSG 59-3, PC-23, PC-9, PC-6, HC-136, MP Chari, CO-FS-29,
3	Hybrid Napier	CO-4, C-23, NB-21, PNB -84
4	Bajra	Giant, L-74, GFB-1, Bajra rajco, HC 20, AVKB-19.
5	Cowpea	EC-4216, NP-3,
6	Guar	BG-1, BG-2, BG-3, Bundel-2, HG 365, HG563, RG- 1003
7	Berseem	BL-I, BL-10
8	Oats	Kent, OS-6,
9	Chinese cabbage	

10. Emphasis be also laid on availability of seeds of short duration and dual purpose crops, which can be used in emergency of drought / floods, for getting fodder in short period. States may ensure availability of such dual purpose quality seeds in consultation with respective Agricultural Universities.

Adopting suitable crop combinations

11. Productivity potential of most lands can be best utilised through not only crop rotation, but also adopting suitable crop combinations. An indicative list of possible production under different combinations of fodder crops is at **Annexure-II** which shows higher productivity for different crops.
12. There is a need to disseminate the benefits of using high yielding quality fodder seeds and combination of crops among the farmers through front line demonstrations (FLD) and minikits. For this purpose, funds available under RKVY, AFDP and Centrally Sponsored Fodder and Feed Development Scheme can be utilised.
13. Cultivation of Azolla may be taken up on large scale as it is highly nutritious, rich in protein and ready within a week's period and available every day thereafter. This Department is implementing a scheme on Establishment of Azolla Production Units. States can avail the benefit for the same, besides utilizing funds under AFDP and RKVY for the purpose.

Improvement of grasslands/wastelands, and other community lands

14. This Department is implementing the component of grassland development including grass reserves with 100% Central grant. States can avail benefit under the scheme. Besides, other marginal lands like roadside land, canal side land, land along the railway tracks, etc., may also be utilised for forage cultivation. The forest department can also undertake silvi-pastoral plantations in degraded forest areas through the Joint Forest Management Committees for use of the communities as explained earlier.
15. Wasteland like waterlogged areas, saline soils, sodic soils, etc., can also be utilized for cultivation of fodder varieties suitable for such areas.

Conservation and Utilization of Crop Residues/Bye-products

16. Diversion of crop residues for industrial use, etc., may be restricted / banned.
17. The State Governments should make it a priority programme to install chaff cutters and construction of manger in each and every household keeping cattle, in order to economize the use of available fodder. This measure can result in saving of upto about 30% fodder.
18. Though, in general, there is scarcity of green fodder in the country, but still in most places surplus green fodder is available during the monsoon. A major part of this surplus green fodder goes waste or is improperly stored, reducing its nutritional value. The farmers may be trained in the techniques like making silage, and be

provided assistance under the Central or State schemes to facilitate silage making at household level.

19. The availability of dry fodder can be enhanced by installation of low capacity Fodder-block making units at each Primary Milk Cooperative / Panchayat level. Tractor mounted fodder block making units are now available, which can be operated in the fields to store surplus fodder/dry fodder. Agricultural refuse can be densified with or without mixing it with easily available material like urea, molasses, butter milk, etc., for easy storage and use during the lean period.
20. State Governments may promote use of crop residues and agricultural wastes/bye-products as animal feed by enriching it through available technologies like treatment of straw with urea and molasses along with silage. Green topping of sugarcane and other crops should be saved for use as fodder.
21. The Government of Haryana has imposed a ban on burning of agricultural refuse in the fields. Other States may also adopt similar controls to prevent wastage or diversion of dry fodder.

Development of Fodder Banks

22. The Milk Cooperatives and Panchayat may be assisted for keeping surplus fodder for use during crisis periods. Gaushalas may be encouraged and trained to popularize high-yielding fodder and forage crops and supported for creating fodder banks through silage or fodder blocks and enrichment of crop residues, etc. States with surplus dry fodder may indicate the quantity and type of fodder available with them, so that necessary arrangements for supply to scarcity area can be made.

Strengthening of Extension activities

23. It has been seen that very less emphasis is given on extension activities for feed and fodder development. States may strengthen extension activities by associating KVKs, which must play a lead role in educating the farmers in maximizing fodder output with limited land and ensuring quality of feed. Progressive livestock farmers may be identified for training through KVKs/SAUs for growing improved varieties of fodder. The progressive farmers can in turn train other farmers.
24. Use of leguminous crops with forage varieties may be popularised through frontline demonstrations through the KVKs. The Regional Fodder Stations of the Government of India have the latest varieties and recommended crop mixtures for the region.

Convergence of fodder schemes with MGNREGA

25. State Governments have been requested earlier to dovetail the fodder and feed development programmes with the MNREGA. The guidelines of MNREGA provide for location-specific grassland development for ensuring adequate fodder supply. The guidelines for the new / additional works permitted under MNREGA also prescribe various livestock related works, including construction of fodder trough (manger) and Azolla units. It is suggested that all the beneficiaries who receive or have received the chaff cutters under any of the Govt. schemes must be provided assistance under MNREGA for construction of fodder trough and Azolla.

**LIST OF FORAGE GRASSES, LEGUMES, SHRUBS AND TREES FOR GRASSLAND/GRAZING LAND
IMPROVEMENT ON AGRO-ECOLOGICAL BASIS**

Agro-eco Regions	Grasses	Legumes	Shrubs/Trees
Western Himalaya, cold arid with shallow skeletal soils	<i>Agrostis spp.</i> , <i>Poa alpina</i> , <i>Trisetum spicatum</i>	<i>Medicago sativa</i> /subsp <i>sativa</i> , <i>M. sativa</i> , subsp <i>fslcuta</i>	<i>Hippophae rhamonides</i>
Western plains and Kaccha Peninsula, hot arid with desert and saline soils	<i>Cenchrus ciliaris</i> , <i>C. setigerus</i> (Sandy plains), <i>Lasiurus scindicus</i> (Sandy interdunal plains), <i>Panicum turgidum</i> (Sand dunes) <i>Chloris gayana</i> , <i>Sporobolus marginatus</i> (salt affected lands)	<i>Cassia rotundifolia</i>	<i>Acacia nilotica</i> , <i>A. tortilis</i> , <i>Albizia lebbeck</i> , <i>Ailanthus excelsa</i> , <i>Dichrostachys cinerea</i> , <i>Prosopis cineraria</i> , <i>Ziziphus nummularia</i> , <i>p. juliflora</i> , <i>Salvadora oleoides</i> , <i>S. persica</i> (Saline soil)
Deccan Plateau, hot arid with red and black soils	<i>Andropogon gayanus</i> , <i>Chrysopogon fulvus</i> (Red soil), <i>Dichanthium annulatum</i> , <i>Bothriochloa intermedia</i> (Black soil)	<i>Clitoria ternatea</i> , <i>Stylosanthes hamata</i> , <i>S. scabra</i>	<i>Acacia nilotica</i> , <i>Albizia amara</i> , <i>A. lebbeck</i> , <i>Desmanthus virgatus</i> , <i>Leucaena leucocephala</i> , <i>Tamarindus indica</i>
Northern plains and central highlands including Aravallis, hot semi-arid with Alluvium	<i>Bothriochloa intermedia</i> , <i>Cenchrus ciliaris</i> , <i>Chrysopogon fulvus</i> , <i>Dichanthium annulatum</i> , <i>Sehima neroosum</i>	<i>Macroptilium atropurpureum</i> , <i>Stylosanthes hamata</i> , <i>S. scabra</i>	<i>Acacia nilotica</i> , <i>A. holosericea</i> , <i>Albizia amara</i> , <i>A. lebbeck</i> , <i>A. procera</i> , <i>Azairachta indica</i> , <i>Dichrostachys cinerea</i> , <i>Hardwickia binata</i> , <i>Leucaena leucocephala</i> , <i>Sesbania grandiflora</i> , <i>S. sesban</i>
Central (Malwa) highlands, Gujarat plains & Kathiawar Peninsula, hot semi-arid with red loamy soils	<i>Bothriochloa intermedia</i> , <i>Chloris gayana</i> , <i>Cynodon dactylon</i> , <i>Dichanthium annulatum</i> , <i>Panicum maximum</i>	<i>Arachis hagenbackii</i> , <i>Clitoria ternatea</i> , <i>Stylosanthes hamata</i> , <i>S. scabra</i>	<i>Albizia lebbeck</i> , <i>Artocarpus lackoocha</i> , <i>Dendrocalamus strictus</i> , <i>Gliricidia sepium</i> , <i>Faidherbia albida</i> , <i>Holoptelia integrifolia</i> , <i>Pithecellobium dulce</i>
Deccan Plateau, hot semi-arid with shallow and medium black soils	<i>Bothriochloa intermedia</i> , <i>Brachiaria decumbens</i> , <i>Cenchrus setigerus</i> , <i>Dichanthium annulatum</i> , <i>Pennisetum pedicellatum</i> , <i>Panicum maximum</i>	<i>Arachis hagenbackii</i> , <i>Stylosanthes hamata</i> , <i>S. scabra</i>	<i>Acacia nilotica</i> , <i>Albizia procera</i> , <i>Anogeissus pendula</i> , <i>Bauhinia variegata</i> , <i>B. purpurea</i> , <i>Leucaena leucocephala</i> , <i>Moringa oleifera</i> , <i>Pterocarpus marsupium</i> , <i>Sesbania sesban</i> , <i>Terminalia arjuna</i>
Deccan (Telangan) Plateau and	<i>Andropogon gayanus</i> , <i>Bothriochloa intermedia</i> ,	<i>Atylosia scrabaeoides</i> ,	<i>Albizia lebbeck</i> , <i>Gliricida sepium</i> , <i>Faidherbia albida</i> , <i>Holopteaia</i>

Eastern Ghats, hot semi-arid with red and black	<i>Chrysopogon fulvus</i> , <i>Pennisetum pedicellatum</i> , <i>Dichanthium annulatum</i>	<i>Macrotyloma axillare</i> , <i>Macroptilium atropurpureum</i> , <i>Stylosanthes scabra</i>	<i>integrofolia</i> , <i>Leucaena leucocephala</i>
Eastern Ghats, TN uplands and Deccan (Karnataka) Plateau, hot semi-arid with red and black soils	<i>Brachiaria decumbens</i> , <i>B. ruziziensis</i> , <i>Cynodon dactylon</i> , <i>Dichanthium annulatum</i> , <i>Bothriochloa intermedia</i>	<i>Arachis hagenbackii</i> , <i>A. glabrata</i> , <i>Stylosanthes guinensis</i> , <i>S. hamata</i>	<i>Ailanthus malabarica</i> , <i>albizia falcataria</i> , <i>Erythrina variegata</i> , <i>E. poppygyana</i>
Northern plains, hot sub-humid (dry with Alluvium derived soils)	<i>Bothriochloa intermedia</i> , <i>Cynodon dactylon</i> , <i>Chloris gayana</i> , <i>Dichanthium annulatum</i> , <i>Pennisetum pedicellatum</i>	<i>Clitoria ternatea</i> , <i>Macroptilium atropurpureum</i> , <i>Stylosanthes hamata</i>	<i>Albizia stipulata</i> , <i>Desmathus virgatus</i> , <i>Azadirachata indica</i> , <i>Ficus racemosa</i> , <i>Leucaena leucocephala</i> , <i>Robinia</i> , <i>pseudoacacia</i>
Central Highlands (Malwa, Bundelkhand & Satpura) noth sub-humid with black and red soils	<i>Andropogon gayanus</i> , <i>Pennisetum pedicellatum</i> (red soil), <i>Bothriochloa intermedia</i> , <i>Chrysopogon fulvus</i> , <i>Sehima nervosum</i> , <i>Dichanthium annulatum</i> (black soil)	<i>Atylosia scarabaeoides</i> , <i>Macroptilium atropurpureum</i> , <i>Stylosanthes hamata</i> , <i>S. scabra</i>	<i>Albizia amara</i> , <i>A. lebbeck</i> , <i>Anogeissus latifolia</i> , <i>A. pendula</i> , <i>Dichrostachys cinera</i> , <i>Hardwickia binata</i> , <i>Leucaena leucocephala</i>
Eastern Palteau (Chhatisgarh), hot sub-humid with red	<i>Bothriochloa intermedia</i> , <i>Cynodon dactylon</i> <i>dichanthium annulatum</i> , <i>Panicum maximum</i> , <i>Pennisetum pedicellatum</i> , <i>Setaria sphacelata</i>	<i>Arachis hagenbackii</i> , <i>Stylosanthes hamata</i>	<i>Bauhinia variegata</i> , <i>Dalbergia sissoo</i> , <i>Leucaena leucocephala</i> , <i>Moringa oleifera</i>
Eastern (Chhotangapur) Plateau and Eastern Ghats hot sub-humid with red and laterite soils	<i>Andropogon gayanus</i> , <i>Bothriochloa intermeida</i> , <i>chrysopogon fulvus</i> , <i>Pennisetum pedicellatum</i> , <i>Urochloa mosambicensis</i>	<i>Atylosia scarabaeoides</i> , <i>Macroptilium atropurpureum</i> , <i>Macrotyloma axillare</i> , <i>Stylosanthes hamata</i>	<i>Artocarpus heterophyllus</i> , <i>A. lakoocha</i> , <i>Leucaena leucocephala</i> , <i>Moringa oleifera</i>
Eastern plain, hot sub-humid (moist) with Alluvium derived soils	<i>Brachiaria brizantha</i> , <i>B. decumbens</i> , <i>B. mutica</i> , <i>Cynodon dactylon</i> , <i>Paspalum notatum</i>	<i>Arachis glabrata</i> , <i>A. hagenbackii</i>	<i>Bauhinia variegata</i> , <i>Dalbergia latifolia</i> , <i>D. sissoo</i> , <i>Desmanthus virgatus</i> , <i>Pterocarpus marsupium</i>

Western Himalayas, warm sub-humid with brown forest and Podzolic soils	<i>Dactylis glomerata, Festuca rubra, Lolium perenne, Poa spp.</i>	<i>Trifolium pratense, T. repens, Lotus comiculatus</i>	<i>Quercus incana, Robinia pseudoacacia, Grewia optiva, Celtis australis, Fagus sylvatica, Celtis australis, Morus alba</i>
Bengal and Assam plains, hot sub-humid (moist) to humid with Alluvium derived soils	<i>Brachiaria decumbens, B. mutica, Paspalum notatum</i>	<i>Desmodium uncinatum, D. heterophyllum</i>	<i>Artocarpus heterophyllum, A. lakoocha, Ficus hookeri, F. nemoralis, Parkia roxburghii, Morus alba</i>
Eastern Himalayas, warm per-humid with brown and red soils	<i>Coix lacryma-jobi, Pennisetum clandestinum, Tripsacum dactyloides</i>	<i>Desmodium spp., Pueraria phaseoloides</i>	<i>Celtis australis, Ficus hookeri, F. nemoralis, F. semicordata</i>
North-eastern Hills (Purvanchal), warm per-humid with red and laterite soils	<i>Brachiaria decumbens, Pennisetum clandestinum, Tripsacum dactyloides</i>	<i>Arachis spp. Desmodium uncinatum</i>	<i>Dendrocalamus hamiltonii, Parkia roxburghii, Morus alba., Robinia pseudoacacia</i>
Eastern Coastal plain, hot sub-humid to semi-arid with coastal Alluvium derived soils	<i>Chloris gayana, Cynodon dactylon, Dichanthium annulatum, Pennisetum pedicellatum, Stenotaphrum dimidiatum, Urochloa mosambicensis</i>	<i>Stylosanthes guianensis</i>	<i>Ailanthus malabarica, Erythrina variegata, E. poeppigiana, Ficus retusa</i>
Western Ghats and Coastal Plain, hot humid per humid laterite and Alluvium derived soils	<i>Cynodon dactylon, Dichanthium annulatum, Panicum maximum, Pennisetum clandestinum, P. polystachyon, Setaria sphacelata</i>	<i>Clitoria ternatea, Desmodium heterophyllum, Pueraria thunbergiana, Stylosanthes hamata, S. guianensis</i>	<i>Ailanthus malabarica, Erythrina variegata</i>
Islands of Andman Nicobar and Lakshdweep hot humid to per humid island with red loamy and sandy soils	<i>Andropogon gayanus, Cynodon dactylon, Cenchrus ciliaris, Pennisetum pedicellatum, p. polystachyon, Brachiaria ruziziensis, Tripsacum laxum</i>	<i>Centrosema pubescens, Clitoria ternatea, Macroptilium atropurpureum, Stylosanthes guianensis, S. scabra</i>	<i>Bauhinia purpurea, Erythrina variegata, Leucaena leucocephala, Trema tomentosa, Pithecellobium dulce, Gliricidia sepium</i>

Stratified fodder-production potential of the best fodder crop combinations

Best 2-3 rotations at various centres	Green fodder yield (q/ha)
(1) Jhansi	
1. Hybrid Napier + Cowpea - <i>Berseem</i> + <i>Sarson</i>	2,863
2. Maize + Cowpea - M.P. Chari - <i>Berseem</i> + <i>Sarson</i>	1,972
3. M.P. Chari - Turnips - Oats	
(2) Hyderabad	
1. Hybrid Napier + Cowpea - Hybrid Napier + Cowpea - Hybrid Napier + <i>Berseem</i>	1,334
2. Maize + Cowpea - <i>Bajra</i> + Cowpea + <i>Berseem</i>	1,267
3. <i>Madikattujonna</i> + Cowpea - Jonna (Ratoon) + Cowpea - <i>Berseem</i>	1,098
(3) Anand	
1. Hybrid Napier alone	2,877
2. Hybrid Napier + <i>Guar</i> - Lucerne	2,529
3. Maize + Cowpea - Maize - Cowpea - Oats - Maize + Cowpea	1,685
(4) Kalyani	
1. Maize + Cowpea - <i>P. Pedicellatum</i> - Oats	1,308
2. Maize + Cowpea - Rice Bean - <i>Berseem</i> + <i>Sarson</i>	1,115
3. Maize + Cowpea + <i>Jowar</i> + Cowpea - Oats	884
(5) Kanker	
1. Maize + Cowpea - Oats - <i>Bajra</i> + Cowpea	1,026
2. <i>Jowar</i> + Cowpea - <i>Berseem</i> + <i>Sarson</i> - Maize + Cowpea	960
3. <i>Bajra</i> + Cowpea - <i>Berseem</i> + <i>Sarson</i> - Maize + Cowpea	959
(6) Pantnagar	
1. Napier + <i>Berseem</i> intercropped and cut at the	2,141

optimum time	
2. Napier + <i>Berseem</i> intercropped and cut at the same time	1,998
3. Napier + Lucerne intercropped and cut at the optimum time	1,960
(7) Jorhat	
1. Hybrid Napier alone	1,442
2. Maize + Cowpea - Maize - <i>Jowar</i> - Oats	664
3. Guinea alone	607
(8) Hissar	
1. Napier - <i>Bajra</i> Hybrid intercropped with <i>Berseem</i>	2,117
2. Napier - <i>Bajra</i> Hybrid + Lucerne	1,760
3. <i>Berseem</i> + Japan Rape - <i>Jowar</i> + Cowpea - <i>Jowar</i> + Cowpea	1,705
(9) Coimbatore	
1. Sorghum + Cowpea - Maize + Cowpea - Maize + Cowpea	1,107
2. Maize + Cowpea - Maize + Cowpea - Maize + Cowpea	1,060
3. Guinea grass round the year	935
(10) Palampur	
1. Maize + Cowpea - Lucerne + Oats + <i>Sarson</i>	844
2. Maize + Cowpea - Turnip - Oats + Pea - Cowpea	833
3. M.P. Chari + Cowpea - Oats + Pea - Cowpea	782
(11) Jabalpur	
1. Hybrid Napier intercropped with Cowpea - <i>Berseem</i> and Cowpea	1,761
2. M.P. Chari - Cowpea - <i>Berseem</i> + <i>Sarson</i> - <i>Jowar</i> + Cowpea	1,686

Based on All-India Coordinated Project for Research on Forage Crops of ICAR