Indian Journal of Animal Sciences **84** (9): 1027–1032, September 2014/Short communication

Adaptation of dairy cattle towards climate change by improved housing and management

S K DAS[1] and N P SINGH[2]

ICAR Research Complex for Goa, Ela, Goa 403 402 India

Received: 28 March 2014; Accepted: 12 May 2014

Key words: Dairy cattle, Impact, Intervention, Milk yield, Microclimate

Livestock is an integral part of agriculture in India particularly in Goa, as most of the people due to multifarious reasons depend on the animal for their economic support. The rise in temperature between 1 and 2°C over the entire country together with increased humidity resulting from climate change is likely to aggravate the heat stress in dairy animals affecting the milk yield and growth of animal. It is reported sporadically in different countries of the world including India that climate change has adverse effect on livestock productivity, particularly on milk production and growth which is reflected in meat production indirectly. St-Pierre *et al.* (2003) estimated a total economic annual loss incurred by the US farm animals due to heat stress at between 1.69 and 2.36 billion US dollars. So, an attempt was made to reduce impact of micro-environmental changes by intervention of housing and management.

Lactating animals (5) of each of the Sahiwal and crossbred (Jersey ×Red Sindhi) cows of 3–4 th lactation were taken from institute farm for this study. Animals were kept in semi-open RCC house with concrete floor and GI sheet roof in one row. Housing modification was done by way of roof modification ie white painting of roof on the outer surface of roof and black painting on the inner surface of roof, to reduce the load of solar radiation as white colour reflects solar radiation and black colour absorbs any solar radiation, if penetrates through roof as well as radiation reflected from floor. Daily splashing of cold water was done on the body surface of cattle thrice ie morning at 7.00 am, noon at 11.00 am and afternoon at 3.00 pm followed by air circulation by electric fans for 1 h as cooling arrangement to reduce heat stress on cows.

Standard feeding and management practices were followed. Animals were allowed for grazing for 2 h. Dry fodder @ 4–5 kg/d, green fodder @ 6–7 kg /d and concentrate @ 5–6 kg/d were fed depending on physiological condition. Concentrate ration was composed of maize crust 50%, rice bran 20%, soycake 17%, Cottonseed cake 10%, vitamin and mineral mixture 2%, common salt 1%. Regular data on milk yield were recorded as per standard procedure. Daily meteorological parameters were recorded as per standard method (IMD 1994). Relative humidity was calculated from standard psychometric table. Temperature humidity index (THI) was calculated as per West (1994). Data were analyzed statistically as per Snedecor and Cochran (1994) using SPSS package.

It was revealed that reduction of milk yield per unit increase of THI was 7 g in Sahiwal, 14 g in crossbred (CB) cows with overall reduction of 10 g after implementation of intervention ie cooling arrangement as well as roof modification. However, reduction of daily milk yield was higher ie 8 g, 19 g and 14 g per unit increase of THI in Sahiwal, CB-cows and overall before intervention.

Effect of change of RH on daily milk yield in Sahiwal, CB-cows was significant ($P < 0.05$) and drop of daily milk yield was 16 g, 22 g and overall value of 19 g per % increase of RH. But after implementation of intervention it was observed that effect of change of RH was non significant and reduction of milk yield was lower ie 5 g, 15 g and 2 g respectively (Fig. 1).

Effect of change of maximum temperature on daily milk yield in CB cows was highly significant ($P < 0.01$) and reduction of yield was 316 g/unit increase of daily maximum temperature before implementing intervention. However, after applying intervention effect of change of maximum temperature on daily yield was non-significant in CB cows and reduction of yield was 66 g only (Table 1).

Monthly milk yield was reduced by 1.002 kg, 1.769 kg in Sahiwal and CB cows with an overall value of 1.639 kg per unit rise of monthly air temperature before intervention (Table 2). However, reduction in milk yield was very less, only 72 g and 82 g in Sahiwal and CB cows with overall value of 8 g/unit rise of monthly air temperature after intervention.

Monthly milk yield was reduced by 18 g, 80 g in Sahiwal and CB cows with an overall value of 20 g/unit increase of monthly RH before intervention. However, monthly milk yield was reduced by 12 g, 54 g in Sahiwal and CB cows with overall value of 16 g/unit increase of monthly RH after intervention. So, reduction in milk yield due to change of RH was lesser after implementing intervention.

Present address: [1]Principal Scientist and In-charge (skdashasnabad@rediffmail.com), Animal Science, [2]Director (director@icargoa.res.in).



Fig. 1. Cattle maintained in semi-open RCC shed with roof modification.

Similarly monthly milk yield was reduced by 127 g, 492 g/unit increase of monthly THI in Sahiwal and CB cows with an overall value of 185 g before intervention. However, monthly milk yield was reduced by 58 g, 191 g in Sahiwal and CB cows per unit increase of monthly THI with an overall value of 64 g after intervention. So, it indicated lesser stress on cows due to change of air temperature, RH and THI in modified housing and managemental condition.

It was revealed that highest maximum temperature, minimum temperature, air temperature, THI, was observed in May in cattle shed. However highest RH was recorded in July. Overall mean value of maximum temperature, minimum temperature, air temperature, RH, THI, maximum wind speed and average wind speed were recorded to be 30.15±0.10 °C, 23.48±0.21°C, 26.87±0.12°C, 79.71±.80%, 79.34±0.23 respectively.

Micro-environment in dairy shed of 2011 was compared with that of 2010 and it was revealed that except in July, October and December air temperature was lower in 2011 than 2010. So, overall mean value in 2011 (26.87 °C) was lower when compared with 2010 (27.64°C). It might be due to arrangement of electric fans. Overall mean RH was lower in 2011 (79.71) than that of 2010 (82.17). Overall mean THI was slightly lower in 2011 (79.34) than that of 2010 (79.38). Maximum temperature was higher in 2010 than that in 2011 except in July, October and December. Overall mean maximum temperature was lower in 2011 (30.15) than that in the year 2010 (30.79). Minimum temperature was lower in all the twelve months in 2011 than that in 2010. So overall mean minimum temperature was lower in 2011 (23.48 °C) than that in 2010 (24.56 °C).

SUMMARY

Effect of change of different micro-environmental parameters had significant influence on daily and monthly milk yield of cows. Influence was more pronounced on crossbred cows than that on indigenous cows. Modification in housing and arrangement of cooling in cattle shed had reduced the heat stress and thereby decreased the milk drop due to change of microenvironment.

REFERENCES

IMD. 1994. Introduction Bulletin of Indian Meteorological Department. Pune, Maharastra.

Snedecor G W and Cochran W G. 1994. *Statistical Methods*. 8th edn. Oxford and IBH Pub Co., New Delhi.

St-Pierre N R, Cobanov B and Schnitkey G. 2003. Economic Losses from Heat Stress by US Livestock Industries. *Journal of Dairy Science* **86**: E 52 – E 77.

West J W. 1994. Interaction of energy and bovine somatotropin with heat stress. *Journal of Dairy Science* **77** (7): 2091–92.

Pashudhan

पशुधन



Indian Livestock Industry Fair

10-14 December 2014
PUNE, MAHARASHTRA

किसान KISAN

KISAN FORUM Pvt. Ltd.
☎ 020- 3025 2000
✉ team@pashudhan.com

pashudhan.com

aay's 2/2014

NUTRIENT REQUIREMENTS OF ANIMALS



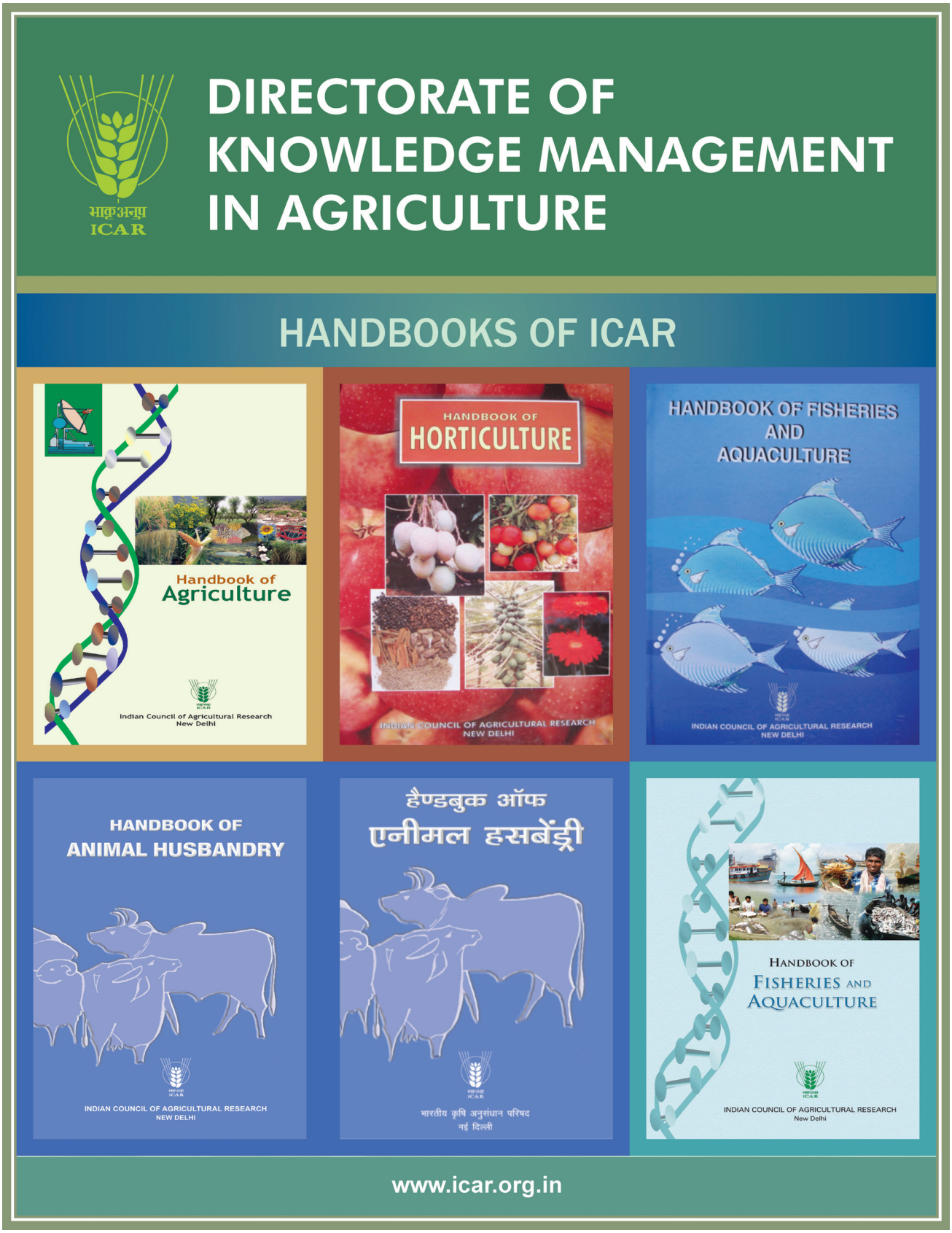
A nutritionally balanced 'livestock feed basket' improves the productivity of animals and simultaneously the economic condition of animal keepers. Feed requirement varies from species to species and from one geographic zone to another depending upon the animal potential and plant-soil-animal relationship. Several institutes of the Indian Council of Agricultural Research, have been working on these crucial aspects of animal nutrition since their inception. Earlier, ICAR published Nutrient Requirement of Livestock and Poultry in 1985 and 1998. Changing climate, vegetation cover and expectations of human population from animal resources have greatly affected the animal sector scenario. Realizing the fact that detailed information is required on nutrient composition of various feeds and fodders, the Council constituted a National Committee on Nutrient Requirements of Animals for compilation of information generated by these institutes.

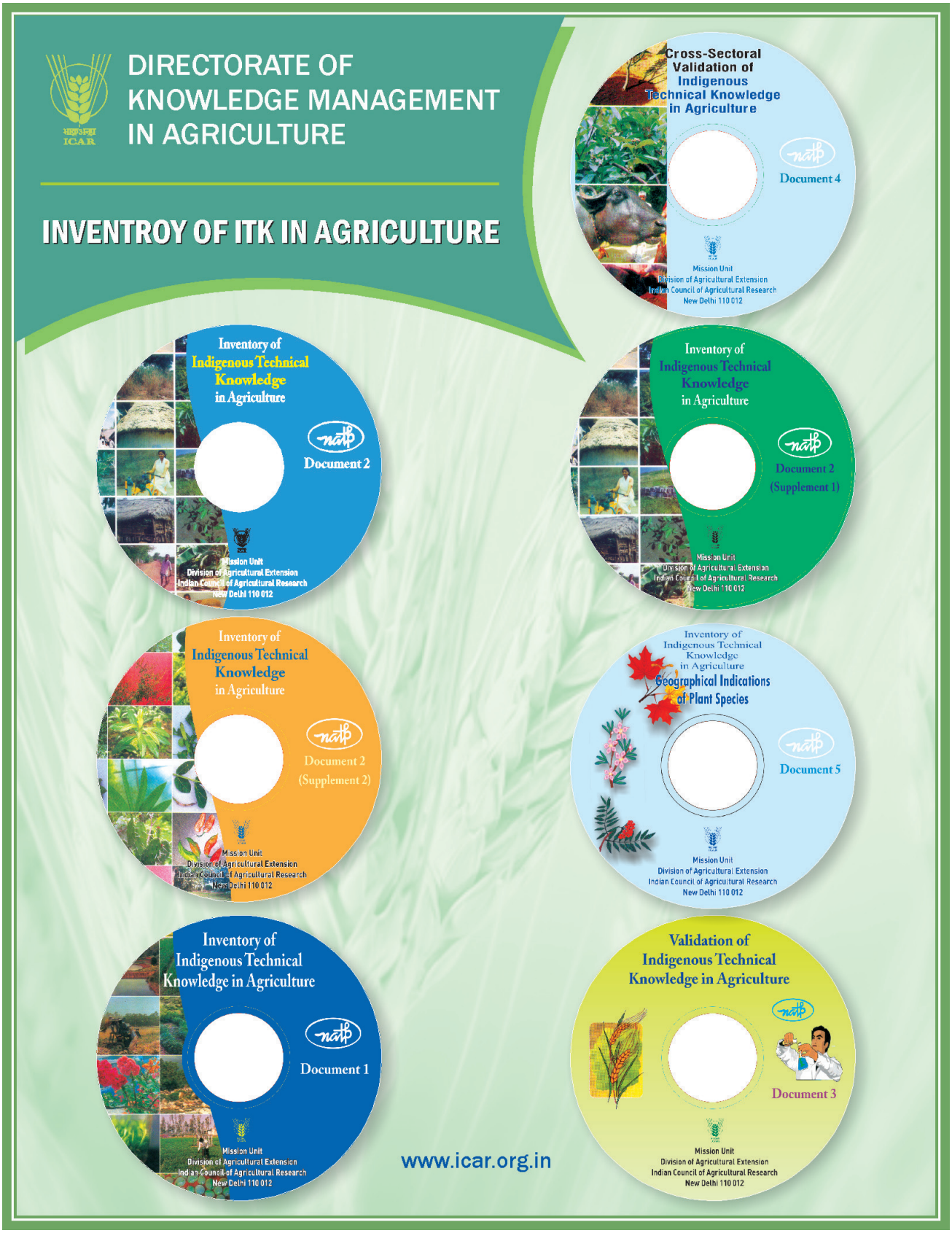
In this present attempt the Committee has brought out 'Nutrient Requirements of Animals' – a series of ten publications. For the first time nutrient requirements of Camel, Yak and mithun, Companion, laboratory and captive wild animals besides Finfish and shellfish have been compiled. This series will be a must reference resource for livestock policy-framers, researchers, academicians, extension officials and grassroot farmers who steer positive changes in the societies' nutritional security and social integration.

Copies available from:
Business Manager
Directorate of Knowledge Management in Agriculture
ICAR, Krishi Anusandhan Bhawan-I, Pusa, New Delhi 110 012
E-mail: bmicar@icar.org.in;
Website: www.icar.org.in

S.No.	Publication Name	Price	Postage
1.	Nutrient Requirements of Cattle and Buffalo	200	30
2.	Nutrient Requirements of Sheep, Goat and Rabbit	200	30
3.	Nutrient Requirements of Poultry	200	30
4.	Nutrient Requirements of Pig	100	30
5.	Nutrient Requirements of Finfish and Shellfish	200	30
6.	Nutrient Requirements of Camel	100	30
7.	Nutrient Requirements of Equine	100	30
8.	Nutrient Requirements of Yak and Mithun	100	30
9.	Nutrient Requirements of Companion, Laboratory and Captive Wild Animals	200	30
10.	Nutrient Composition of Indian Feeds and Fodder	200	30

* Postage for complete set of 10 publications₹ 200/-


DIRECTORATE OF
KNOWLEDGE MANAGEMENT
IN AGRICULTURE
भाकृअनुप
ICAR
HANDBOOKS OF ICAR
Handbook of
Agriculture
Indian Council of Agricultural Research
New Delhi
HANDBOOK OF
HORTICULTURE
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI
HANDBOOK OF FISHERIES
AND
AQUACULTURE
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI
HANDBOOK OF
ANIMAL HUSBANDRY
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI
हैण्डबुक ऑफ
एनीमल हसबेंड्री
भारतीय कृषि अनुसंधान परिषद
नई दिल्ली
HANDBOOK OF
FISHERIES AND
AQUACULTURE
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
New Delhi
www.icar.org.in


DIRECTORATE OF
KNOWLEDGE MANAGEMENT
IN AGRICULTURE
ICAR
INVENTROY OF ITK IN AGRICULTURE
Cross-Sectoral Validation of Indigenous Technical Knowledge in Agriculture
Document 4
Mission Unit
Division of Agricultural Extension
Indian Council of Agricultural Research
New Delhi 110 012
Inventory of Indigenous Technical Knowledge in Agriculture
Document 2
Mission Unit
Division of Agricultural Extension
Indian Council of Agricultural Research
New Delhi 110 012
Inventory of Indigenous Technical Knowledge in Agriculture
Document 2 (Supplement 1)
Mission Unit
Division of Agricultural Extension
Indian Council of Agricultural Research
New Delhi 110 012
Inventory of Indigenous Technical Knowledge in Agriculture
Document 2 (Supplement 2)
Mission Unit
Division of Agricultural Extension
Indian Council of Agricultural Research
New Delhi 110 012
Inventory of Indigenous Technical Knowledge in Agriculture
Geographical Indications of Plant Species
Document 5
Mission Unit
Division of Agricultural Extension
Indian Council of Agricultural Research
New Delhi 110 012
Inventory of Indigenous Technical Knowledge in Agriculture
Document 1
Mission Unit
Division of Agricultural Extension
Indian Council of Agricultural Research
New Delhi 110 012
www.icar.org.in
Validation of Indigenous Technical Knowledge in Agriculture
Document 3
Mission Unit
Division of Agricultural Extension
Indian Council of Agricultural Research
New Delhi 110 012