

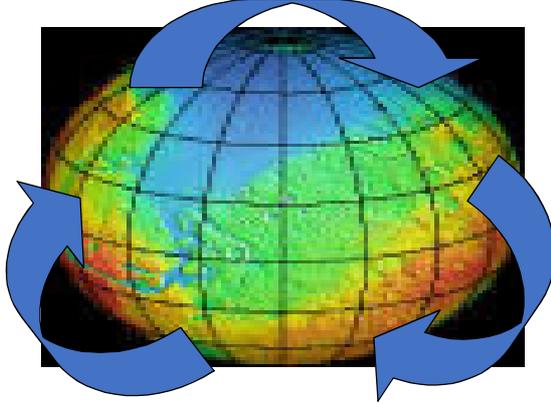


Bioresources led climate smart agriculture for food and nutrition security in Rajasthan

R. S. Paroda

Way Forward

Think Globally



Act Locally

Indian Agriculture

Main Achievement

From “Bagging Bowl Status”
To an Era of Self Sufficiency”

Green Revolution

A Science led Success

Main Cradles :

- 1. Policy Support**
- 2. Institutions**
- 3. Human Resource**
- 4. Partnership**

Impact of Green, White & Blue Revolutions

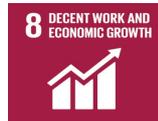
- Six fold increase in food grains production (50 mt – 295.67 mt)
- Horticulture production > 320 mt
- Reduction in poverty (From 70% - 20%)
- Maintaining Buffer stock > 50 mt
- Milk Production From 20 mt -184 mt
- Fish Production: <1 mt – 12.6 mt
- Export > US \$ 40 billion

Record Production this year :

**Food grains, Rice, Wheat, Maize,
Oilseeds, Cotton**

Yet we need to move fast

Only 10 years left to achieve SDGs (2030)



Global Food and Nutrition Insecurity

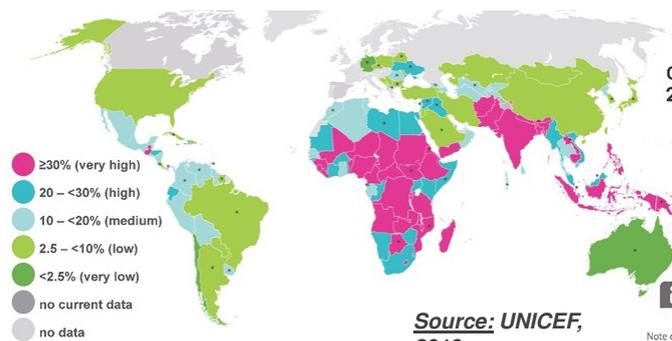
88% of countries face serious 2-3 forms of malnutrition

2 billion people lack key micronutrients (iron, vit. A)

155 million children stunted

2 billion adults overweight or obese

41 million children overweight



Percentage of children under 5 who are stunted (%), by country, 2018

Note: Country Data are the most recent available estimate between 2012 and 2018; exceptions where older data (2000-2011) are shown are marked with an asterisk (*) and where only data prior to 2000 are available the dark grey color denoting no recent data is used.

Source: UNICEF, 2019

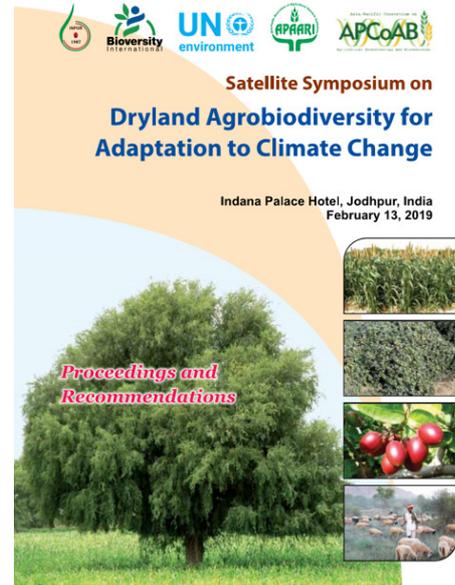
The world is off-track for meeting global nutrition targets

Source: EAT-Lancet Commission Report, 2019

Agrobiodiversity for Resilience, Nutrition and Livelihoods

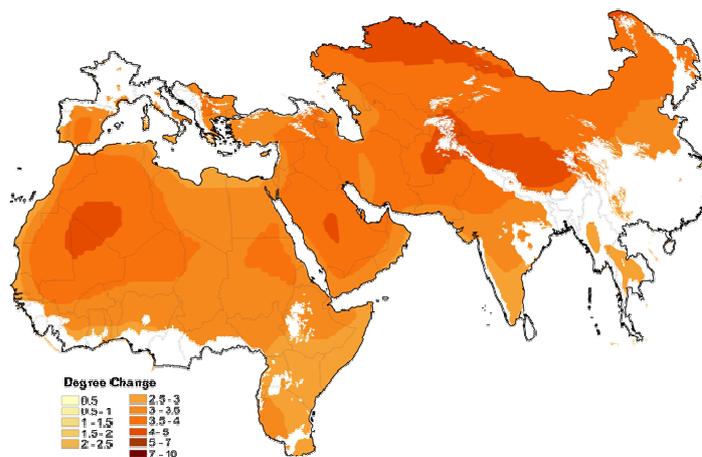
- A Road Map needed for efficient conservation and sustainable use of dryland agrobiodiversity
- Greater emphasis on genetic enhancement – More use of PGR
- Reorienting farming systems around local agrobiodiversity
- Agro-processing, value addition and market linkages
- Incentives for ecosystem services
- Network/consortium of farmers and institutions for on-farm conservation

COVID-19 – Need for dependence on local food systems

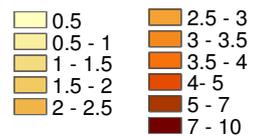


Climate change is a reality

Relative change of mean annual temperature
1980/1999 to 2080/2099 (100 years)



Degree Change

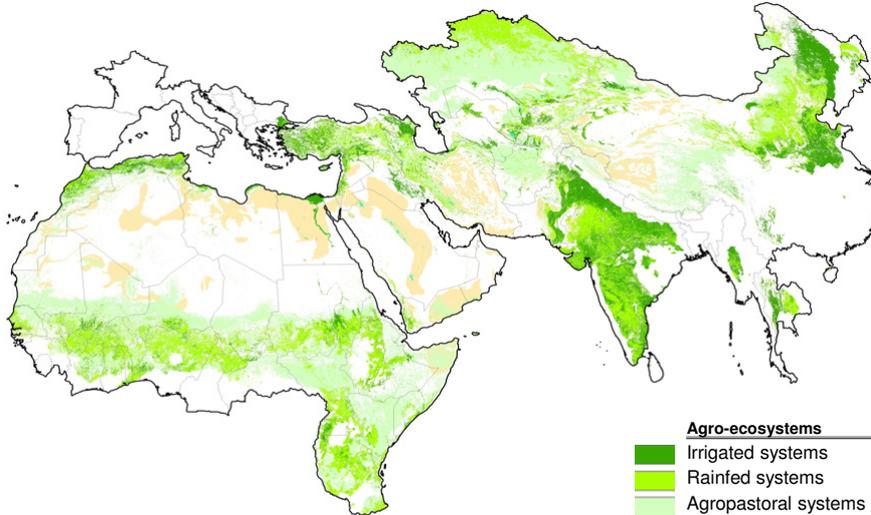


2 degree increase = 20% less food



Source: CGIAR-DryArc Initiative (2020)

Drylands are critical for achieving SDGs



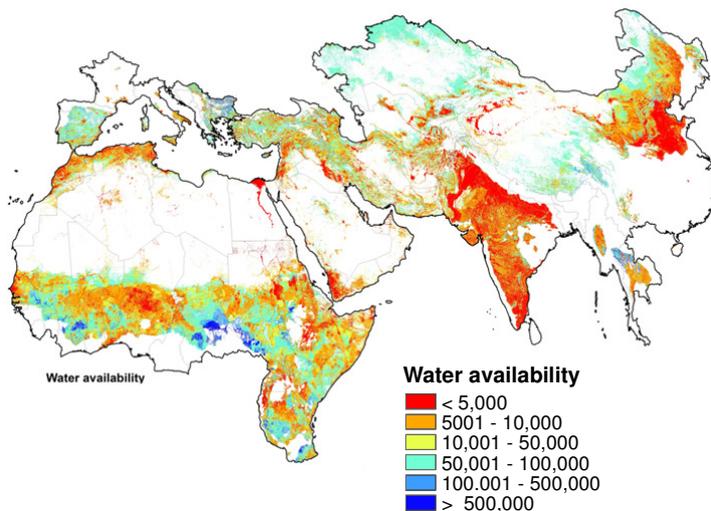
- 35% of world Agricultural land areas Inhabited by 27% (2 billion) of the world population and 48% (1.4 billion) of the worlds' livestock.
- Home to majority of the world's poor, with around 16% living under chronic poverty

Agro-ecosystems	Area (m ha)	%
Irrigated systems	312	15
Rainfed systems	512	25
Agropastoral systems	873	43
Desert farming Potential	342	17

Source: CGIAR-DryArc Initiative (2020)

9

Water Scarcity - A Major Concern



Water availability

- 1,100 m³/person/year
- half of the amount for basic well being
- Set to drop to 550 m³/year by 2050

80% of total water used in agriculture

Source: CGIAR-DryArc Initiative (2020)

10

Emerging Pests and Diseases



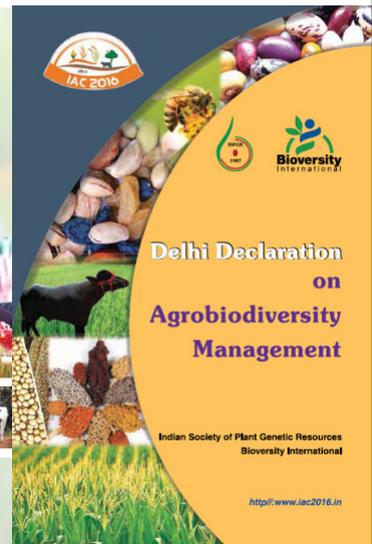
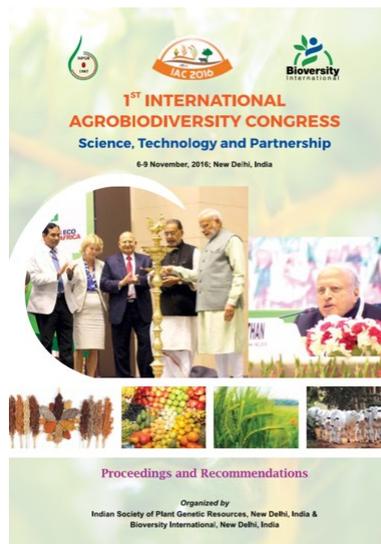
- Desert Locust
- Fall Army Worm
- Wheat Blast
- Many More



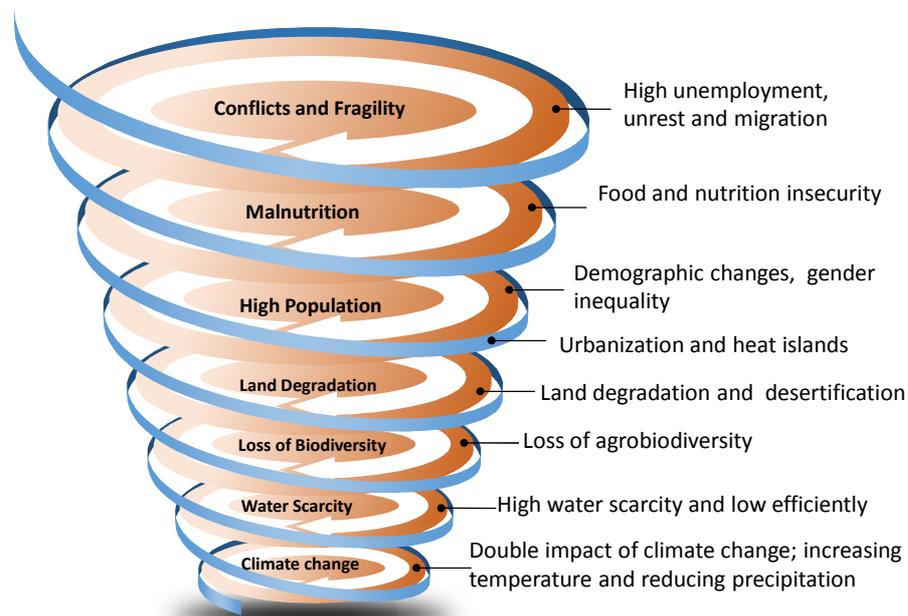
11

Loss of Agrobiodiversity

- **+ 1.5-2.5°C → 20-30 % of species at risk of extinction**
- **+ 3.5°C → 40-70 % of species at risk of extinction**
(IPCC 2007, Synthesis Report)



A Perfect Storm



Source: CGIAR-DryArc Initiative (2020)

13

Agriculture in Rajasthan The Context

Rajasthan is unique in many ways

Not only for its velour, old culture and traditions but also its rich biodiversity

Largest State of India covering nearly 10.4 % of total geographical area of the country

Nearly 65% of its population (8 crore) is dependent on agriculture

Almost 10 million rural youth (including women)

Agricultural Challenges in Rajasthan

- In Rajasthan, out of 295 blocks, 185 Blocks are in Dark Zone. Even 3 Blocks have no drinking water.
- Water scarcity and inefficient use- *Flood irrigation be banned and micro-irrigation be intensified*
- Climate Change- *Drought and erratic rainfall – monsoon contraction and flash floods*
- Lack of value chain for high-value crops
- Feed scarcity and underdeveloped livestock markets
- Ban on Animal Slaughter- *Sheep and goat- a major share with high potential*
- Enabling policy support for Agri-exports ?
- Underinvestment in agricultural research- *less than 0.2% of GDP; much below most of the states*

Doubling Farmers' Income: Issues and Strategies for Rajasthan
Final Report



NABARD, 2018

High Grazing & Browsing Pressure

- >5 times in arid region
- >3 times of the normal in semi-arid region

Ziziphus nummularia



Coparris decidua



Acacia jacquemontii



Contributing Towards Indian Agriculture A Few Successes

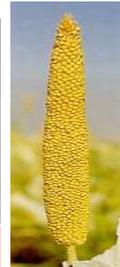


- 12% of country livestock, 13% milk, and 33% wool
- Animal Husbandry Sector contributes 8.74% to GSDP
- One of the largest states in India taking part in organic farming, with over 81,000 hectares of registered organic farm area.
- **No.1: Bajra, Moth, Mustard, Guar, Coriander, Fenugreek, Heena, Isabgol, Wool,**
- **No 2: Gram, Cumin, Milk**
- **No 3. Soybean, Pulses, Oilseeds**
- **No 4: Garlic**

Pearl millet - lifeline in the arid region

Promising sources identified in Dr Raj. S. Paroda Genebank at ICRISAT

Stress/Nutritional traits	Accessions screened	Promising sources identified
Salinity	48	32
Drought	115	8
Heat	238	6
Ergot	2,752	283
Downy mildew	4,727	65
Rust	2,229	332
Smut	1,747	397
Downy mildew	534	222
Nutritional traits		
High seed protein content (>15%)	1,735	272
High seed iron content (>80 ppm)	387	41
High seed iron and zinc content (>60 ppm)	387	33
High seed zinc content (>60 ppm)	387	42
Yellow endosperm	137	2



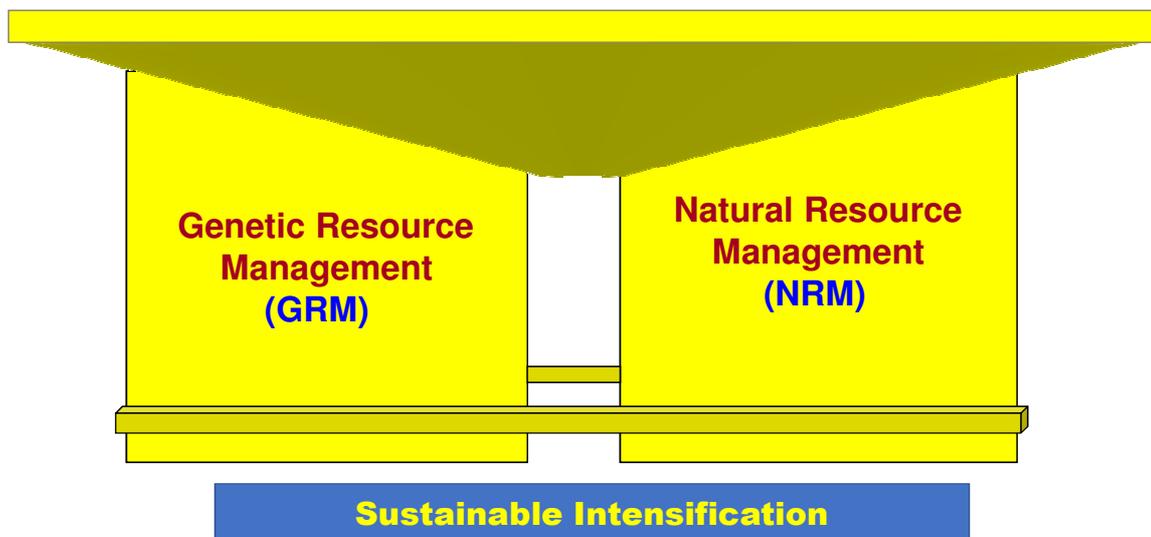
Yadav et al., 2018

What is Needed ?

- Increase in Crop Yield and Income
- Improving Soil Health – OM & NUE
 - Water Harvesting and Water Use efficiency
- Farm Mechanization and GAP
 - Agricultural Diversification (Horticulture, Dairy, Poultry, Fishery, Agro-forestry etc.)
- Post-harvest Processing , Value Addition and Marketing



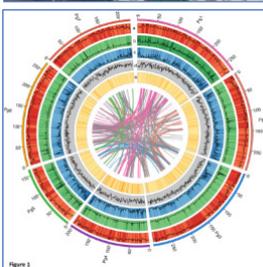
Twin Pillar Strategy



Opportunities

- **Unique Agrobiodiversity**
- Crops: Bajra, Sarson, Moth, Moong
- Seed Spices: Jeera, Dhania, Methi, Ajwain
- Fruits: Ber, Aonla, Anar, Ker, Datepalm
- Medicinal Plants: Isabgol,
- Grasses: Sewan, Dhaman
- Trees: Khejri, Rohida, Babool, Neem
- Cattle: Tharparkar, Rathi, Gir, Kankrej, Nagouri
- Sheep: Magra, Bikaneri, Chokhla
- Goat: Marwari

Harnessing Bioresources for Higher Productivity



- **Unique** (often exclusive) germplasm
- Germplasm highly **adapted to climate change**
- Useful genetic material with inbuilt tolerance to abiotic stresses – **draught, salinity, high temperature etc.**
- Excellent genetic resource for isolation of candidate genes – Ex. **Kharchia wheat for salt tolerance**

Ex Situ Conservation - NBPGR

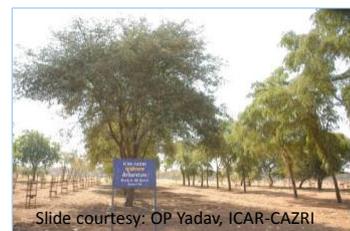
Crop	Indigenous Collections	Exotic Collections	Total Collections
Pearl Millet (<i>Pennisetum glaucum</i>)	8000	830	8830
Barnyard Millet (<i>Echinochloa esculanta</i>)	1917	08	1625
Finger Millet (<i>Eleusine coracana</i>)	11014	109	11123
Foxtail Millet (<i>Setaria italica</i>)	4498	81	4579
Kodo Millet (<i>Paspalum scrobiculatum</i>)	2368	01	2369
Sorghum (<i>Sorghum bicolor</i>)	11211	9067	20278
Moth (<i>Vigna aconitifolia</i>)	1459	31	1490
Mung (<i>Vigna radiata</i>)	3347	405	3752
Cluster bean (<i>Cyamopsis tetragonoloba</i>)	3967	31	3998
Sesame (<i>Sesamum indicum</i>)	6921	2411	9332
Rape Seed & Mustard (<i>Brassica</i> sp.)	1895	63	1958
			69333

Courtesy : OP Yadav, CAZRI



Collections of Horticultural and Agro-forestry Crops

Crops	Accessions /varieties
Ber (<i>Ziziphus mauritiana</i>)	318
Pomegranate (<i>Punica granatum</i>)	357
Aonla (<i>Emblica officinalis</i>)	50
Date palm (<i>Phoenix dactylifera</i>)	61
Citrus spp.	614
Guava (<i>Psidium guajava</i>)	150
Gonda (<i>Cordia myxa</i>)	85
Bael (<i>Aegle marmelos</i>)	427
Kair (<i>Capparis decidua</i>)	11
Khejri (<i>Prosopis cineraria</i>)	22
Karonda (<i>Carissa carandas</i>)	29
Fig (<i>Ficus carica</i>)	12
Matira (<i>Citrullus lanatus</i>)	65
Snap melon (<i>Cucumis melo</i> var. <i>Momordica</i>)	65
Kachri (<i>C.melo</i> var. <i>callosus</i>)	68



Slide courtesy: OP Yadav, ICAR-CAZRI

Germplasm of Seed Spices (2125)

Major Seed Spices		Minor Seed Spices	
Crop	No. of germplasm	Crop	No. of germplasm
Cumin	247	Ajwain	100
Coriander	549	Dill	111
Fennel	297	Nigella	24
Fenugreek	733	Celery	36



Courtesy : Gopal Lal, NRCSS

Mothbean – a most resilient pulse crop

- **Consistent area – around 1.5 m ha**
- **No better substitute available**
- **Research for new plant type and high yielding varieties needed**
- **Must be protected under GI**



High Value Crops



- Methi from Nagaur
- Mirchi (Chilli) from Mathania, Jodhpur
- Henna from Sojat



- Resilience against risks
- Opportunity for income
- Employment for youth through value addition/processing
- Foreign exchange

Unique Grasses of Thar Desert

-The lifeline for Livestock in Rajasthan

Germplasm Conservation :

<i>Lasiurus indicus-</i>	111
<i>Cenchrus ciliaris-</i>	85
<i>Cenchrus setigerus-</i>	42
<i>Panicum antidotale-</i>	47
<i>Panicum turgidum-</i>	02
<i>Cymbopogon sp-</i>	24
<i>Clitoria. ternatea -</i>	09
<i>Lablab purpureus -</i>	02
<i>Indigofera sp-</i>	01



Courtesy: OP Yadav, CAZRI

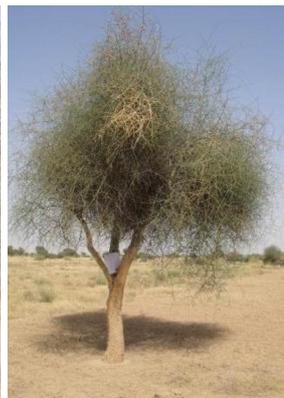
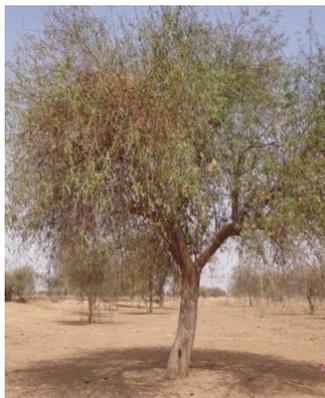
Khejri – a Multi-purpose Tree

- Used as food, fodder, fuel and building materials
- It also adds nitrogen to the soil
- Does not smother crops underneath

- During years of drought, when annual crops fail, farmers rely heavily on the products of Khejri for their own and animals survival.



World's Unique Tree Species



- Nutritious fodder for livestock under multiple stresses
- Very high C-sequestration under limited water availability (high C sequestration potential per unit of water)
- A risk management strategy for the smallholder and resource poor farmers (fixed deposit with more interest than the bank)

More research needed

Agrobiodiversity and ecosystem services – to be compensated



Recognition for conserving agro-biodiversity - Kharchia Wheat



Sl. No. : 001744

Application No: F1TA1/3413
Date of Filing: 31-07-2013

FORM O-2
(Sec rules 26 and 37)
GOVERNMENT OF INDIA, PLANT VARIETY REGISTRY
CERTIFICATE OF REGISTRATION

Registration No. 61 of 2015

Whereas Farming Community of Kharchi Village, Village - Kharchi, PO - Kharchi Junction, P.S. - Rajpootan has declared that he has developed Kharchia Local (Dhakat) as farmer variety

plant variety / essentially-derived plant variety and that he is the true breeder thereof (or the legal representative or assignee of the true breeder) and that he is entitled to a plant variety right on the said variety, having regard to the provisions of the Protection of Plant Varieties and Farmers' Rights Act, 2001 and that there is no objection to the registration of plant variety in favour of him.

And whereas he has, by an application, requested that registration of plant variety / essentially derived plant variety may be allowed to him for the said plant variety;

And whereas he has, by and in his application, particularly described the various distinctive features and mentioned the denomination of the said plant variety;

Now, these presents that the above said applicant (including his legal representative and assignee or any of them) shall, subject to the provisions of the Protection of Plant Varieties and Farmers' Rights Act, 2001 and the conditions specified in section 47 of the said Act, and to the conditions and provisions specified by any other law for the time being in force, have the exclusive right to produce, sell, market, distribute, import or export the variety for a term of starting period of 20.15 years from the 05 day of October 2015 and of authorizing any other person to do so, subject to the conditions that the validity of this registration is not guaranteed and that the fee prescribed for the continuance of this registration are duly paid.

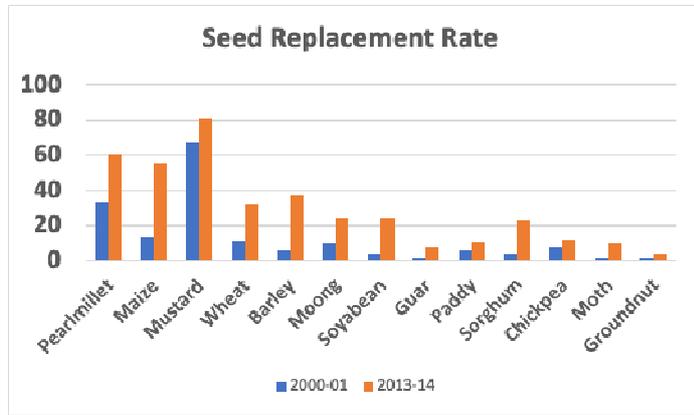
In witness thereof, the Registrar has caused this registration to be sealed as of the 05 day of February 2015.

Pawan Prasad

Seal and Signature of the Registrar,
Plant Variety Registry
Date of Grant 05-2-2015

Note : The fees for maintenance of this registration, if it is to be maintained, will fall due on 04 day of Feb 2016 and on the same day in every year thereafter.

Seed Replacement Rate



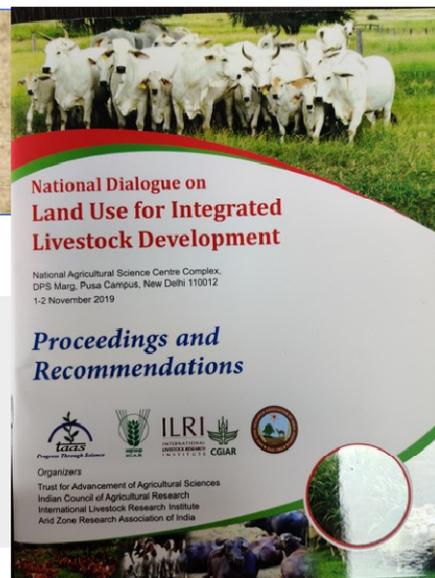
Livestock Diversity- Pushkar



Unique Livestocks

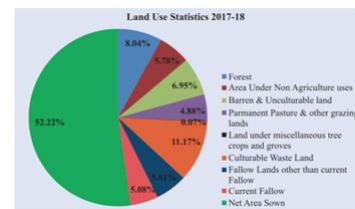


- Highly adapted livestock species to harsh climate
- Most efficient breeds – a real lifeline for dryland farmers
- Rich traditional knowledge



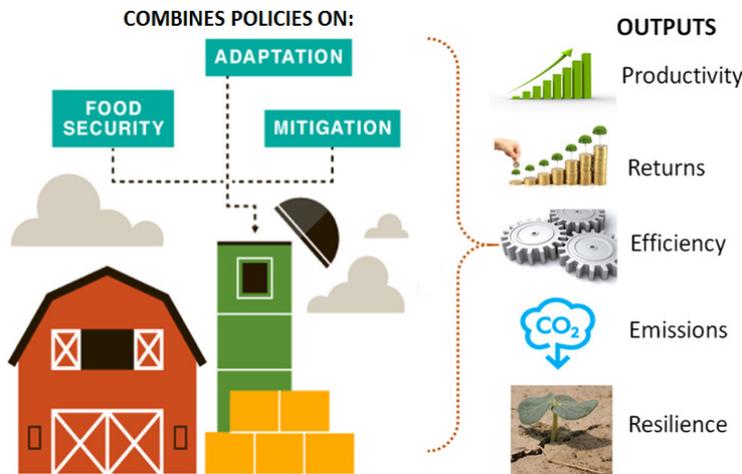
Towards Good Agronomic Practices (GAP)

- Scientific land use
- Conservation Agriculture
- Climate smart agriculture
- Integrated Farming Systems - Eco-region wise
- Organic farming (nitch areas & crops)
- Microirrigation + Fertigation + Solar energy



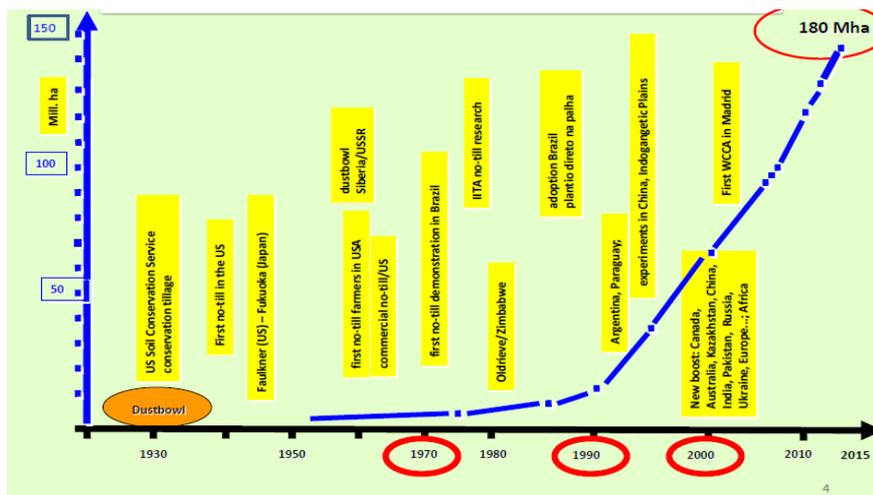
Climate-Smart Agriculture in Rajasthan

Need for Practices and Policies



- Rajasthan badly need CSA
- Unique bio-resources for climate smart agriculture
- Ample opportunities through traditional farming systems
- Need a new strategy and action plan

Conservation Agriculture – Practiced Globally



Source: Kassam et al (2018)

- Have paid dividends for reversal of land degradation, improving productivity and farm profits in rainfed regions
- Since 2009, CA increasing @ 10 million ha annually
- Has high potential for drylands - Rajasthan
- Need policy support for scaling CA
- Youth can play a key role

CA in South Asia – Very Slow Adoption (Currently 5.0 mha)

Continent	Cropland under CA (m ha)	Per cent of global CA area
South America	66.4	42.3
North America	54.0	34.4
Australia & NZ	17.9	11.4
Asia	10.3	6.6
Russia & Ukraine	5.2	3.3
Europe	2.0	1.3
Africa	1.2	0.8
Global total	157.0	100

Country	CA area '000ha 2008/09 update	CA area '000 ha 2013 update
China	1,330	6,670
Kazakhstan	1,300	2,000
India	-	1,500
Turkey	-	45
Syria	-	30
Korea, DPR	-	23
Iraq	-	15
Uzbekistan	-	2.45
Azerbaijan	-	1.30
Lebanon	-	1.20
Kyrgyzstan	-	0.70
Total	2,630	10,30

Kassam et al (2015)

Conservation Agriculture for Sustainable Intensification

Example from irrigated intensive systems in IGP

- Sustainable intensification of cropping systems can help reduce costs, increase incomes and make agriculture more sustainable for small farmers and the environment



↑
5-10% System Yield
(increased)

↓
8-17% Irrigation
Water (saving)

↓
26-44% Labor (saving)



↓
46-62% Energy (saving)

↑
16-56% Profitability
(increased)

↓
11-16% CO₂ reduction
from farming and
avoided stubble
burning

Synthesis from ICAR-CIMMYT research in India



**Need to Conserve Every Drop of Water
(Khet ka Pani Khet Mein)**



- Rain water harvesting is key to future success
- Adopting farming systems which maximizes water productivity

Climate Smart Agriculture

Rain-water harvesting + Solar energy + sub-surface fertigation + CA



GOVERNMENT OF RAJASTHAN

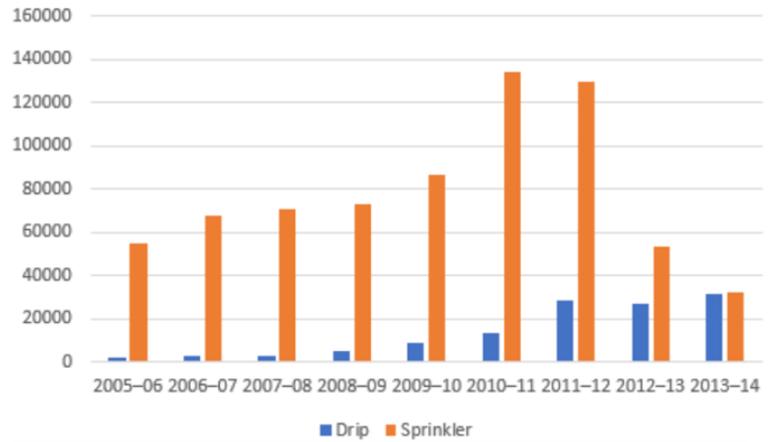
Approved by
Cabinet in 2013

STATE AGRICULTURE POLICY



Department of Agriculture, Rajasthan, Jaipur

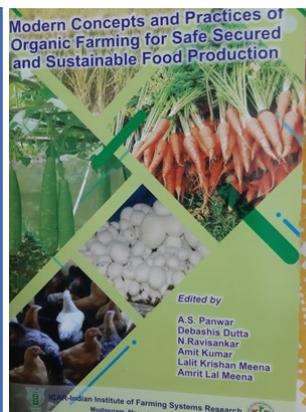
Trends in Micro-Irrigation System in Rajasthan



**Narmada Canal in 2008 - 74 km (out of total 458 km)
A major policy decision – No flood irrigation)**

Towards Organic Agriculture *Rajasthan has ample opportunities*

- Globally, OF acreage is 112.2 m ha in 181 countries (IFOAM FiBL Report 2019).
- OF is growing at 12 % annually
- India - 3.56 m ha under organic production
- Market size- US\$ 97 billion (2017)
- During 2017-18, India exported 0.46 m t of organic produce worth Rs 3453 crores.
- Madhya Pradesh (36 %) and Maharashtra (23 %) are the leading states
- **Rajasthan can do much better**



- Niche areas and crops (Low volume high value crops), and the organic farming practices
- **RAJASTHAN IS A De-Facto Organic area**
- Declaring “Special organic farming zones”.
- Incentives to farmers for improving soil, human and environmental health - MSP + 25% premium
- Integrated Organic Farming System (IOFS) Approach
- Engaging youth for entrepreneurship on organic farming (production, processing, value addition, marketing)
- Centres of Excellence (in DAUs) for basic, strategic and applied research



Youth and Agriculture

- Global population is expected to be 9 billion by 2050; youth around 20 %
- **India has a comparative advantage over other countries with 356 million youth between 10-24 years age group; nearly 200 million living in rural areas**
- India's population is expected to remain young longer than that of China and Indonesia
- **Average age of the Indian population is 30 years, as against 40 in USA, 46 in Europe and 47 in Japan**
- Agriculture is a key sector, sustaining around 55 % of India's population
- **Youth and agriculture are the twin pillars for achieving SDGs**



Challenges Before Youth in Agriculture

- Lack of access to good knowledge resulting in failure of new initiatives - needing institutional back up
 - **Limited access to land - small land holdings**
 - Lack of financial resources
 - **Difficulties in linking to markets**
 - No voice in decision-making
 - **Poor social image of agriculture and lack of infrastructure facilities in rural areas**
 - There exists 'aspiration-attainment gap' due to lack of hand holding, mentorship and funding support
- 

Global/Regional Initiatives



- Challenge to retain youth in agriculture figured prominently in the Global Conference by GFAR in New Delhi - 2006.
- An international forum of Young Professionals for Agricultural Development (YPARD) was launched under the umbrella of GFAR at FAO, Rome
- The importance of youth in agriculture was structurally debated during GCARD 1 and 2, organized in 2010 and 2012, respectively
- Regional Workshop on 'Youth and Agriculture: Challenges and Opportunities' organized in Islamabad - 2013

Motivating & Attracting Youth in Agriculture (MAYA)

To be Job Creator and not Job Seeker:

- Youth (including women) as extension agents – Paid extension
- Youth as input providers
- Youth as Entrepreneurs

Promoting the model of Agri-Clinic in each District (involving KVK, ATMA and Private Sector)



Regional Conference on Motivating and Attracting Youth in Agriculture (MAYA)

A.P. Shinde Symposium Hall
NASC Complex, Pusa Campus, New Delhi
30-31 August, 2018

Proceedings and Recommendations

Organizers
Trust for Advancement of Agricultural Sciences (TAAS)
Indian Council of Agricultural Research (ICAR)
MS Swaminathan Research Foundation (MSSRF)
Asia-Pacific Association of Agricultural Research Institutions (AAPARI)
Skill India, Agriculture Skill Council of India (ASCI)
Young Professionals for Agricultural Development (YPARD)
National Bank for Agriculture and Rural Development (NABARD)



Options Available - A Fifteen Point Agenda

1. **Improved seed production - Hybrids**
2. **Certified nursery for quality plants**
3. **Knowledge sharing through ICT**
4. **Paid extension services**
5. **Quality input supply**
6. **Farm mechanization – Custom Hire Centres (CHCs)**
7. **AGRI-CLINICS**
8. **Post-harvest processing and value addition**
9. **Micro-irrigation**
10. **Contract farming – FPOs**
11. **Protected cultivation**
12. **Conservation agriculture**
13. **Accredited Laboratories – Soil and water analysis, Organic produce, Seed quality, Biofertilizers, pesticides & Biopesticides**
14. **Inland fishery – including spawn production**
15. **Flower production - including seed production**

MAYA - Road Map

- **Separate ‘Department of Youth in Agriculture’**
- **Establish a ‘National Mission on Youth in Agriculture’**
- **Encourage youth to set-up agri-service centres**
- **Encourage youth to get involved in e-NAM, start-up, stand-up and skill development schemes, agri-business enterprises, FPOs etc**
- **Need for paradigm shift from narrow focus on ‘youth as a farmer’ to ‘youth as a value chain developer’ to harness better economic opportunities**
- **Govt. to provide enabling policy environment for long-term investments, easy and soft credit availability, provision of subsidy to entrepreneurs, easy market linkage, land, water and market law reforms, and tax exemption for rural-based primary value addition by youth**
- **The private sector to help create an ‘Agri-Youth Innovation Corpus Fund’ and facilitation for creation of Agri-Clinics under corporate social responsibility (CSR)**

Opportunities for Youth - Seed Spices Sector- An Example

- **Diversification through seed spices**
- **Seed production**
- **Organic farming**
- **Processing & value addition**
- **Export of seed spices**



Source: Dr Gopal Lal, NRCSS

Enhancing Income from Goat Milk

- Goat milk is nutritionally superior to cow milk having 12.6 % total solid, 3.8 % fat, total protein 4.8%, lactose 3.7% and ash 0.8%
- The essential minerals like Ca, K, Fe, Mg, P, and Cu are significantly higher in goat milk
- Average shelf life of goat milk is 5-7 hr, 11-14 hrs and 9-13 hrs during summer, autumn and winter, respectively. Goat milk can be processed into different products like paneer, kulfee, flavoured whey drink etc.



Prosopis juliflora based complete feed block/mixture

- To prepare multi block/mixture mixtures, clusterbean meal replaced by *P. Juliflora* seed meal
- The feed block/nutrient mixture supplementation in the animals increased feed intake, regulated rumination, corrected pica, regularized the breeding cycle and improved fertility
- Supplementation of these feed blocks and nutrient mixture increased daily milk yield (20-25 %) in cattle and buffalo maintained under grazing conditions



Value added products



Aloe vera cultivation and its products

Arid Horticulture : Own Experience



Rajasthan

Institutional Support Available

State Agricultural Universities – 5 + 1 (Veterinary)

ICAR Institutes – CAZRI, CSWRI, NRC on Camel

NIAH, NRC on Mustard, NRC on Seed Spices,

PD on Bajra,

KVKs - in Each District

State Department of Agriculture, Horticulture, Animal Husbandry and Fisheries

**A mechanism for convergence, coordination is must
State Council for Agricultural Research, Education and Farmers'
Welfare Needed**

Opportunities for SKNAU

Specialized crops	Secondary agriculture	Scale appropriate mechanization & Conservation Agriculture for drylands	Agro-biodiversity	Specialized farming systems	Incubation hub for Agriculture Youth
<ul style="list-style-type: none"> • Bajra • Barley • Taramira • Seed spices • Clusterbean • Mothbean • Mungbean • Chikory • Grasses 	<ul style="list-style-type: none"> • Peri-urban • Mushroom production, • Honey • Medicinal and herbal 	<ul style="list-style-type: none"> • Mechanization hub for Rajasthan • Collaboration with PAU, ICAR-CIAE, CIMMYT, Private Manufacturers etc. 	<ul style="list-style-type: none"> • Specialized in situ agro-biodiversity genebanks (conservation, utilization and facilitation) 	<ul style="list-style-type: none"> • Agro-forestry based farming systems • Secondary agriculture • Protected cultivation 	<ul style="list-style-type: none"> • Formal education • Informal education • Handholding and mentoring of young entrepreneurs

**Collage of Agriculture & Food Science,
Collage of Horticulture & Agro-Forestry, Collage of Animal Husbandry & Fisheries**

Conclusions

- Our future challenge is for food, nutrition, health and environmental security
- Agriculture is not the cause but solution for achieving SDGs and to bridge the widening gap between rich and poor – Yet, the business as usual will not do
- The task ahead is indeed difficult, but not insurmountable provided needed policy support is given and AR4D funding is doubled
- Scaling innovations would require right incentives, policies, institutions, human resource (mainly youth) and public private partnership
- So, we must have a clear Way Forward and act fast to achieve secure and sustainable agriculture as defined in our report to the Government of India



Report on Policies and Action Plan for a Secure and Sustainable Agriculture

30 August, 2019

Submitted to
**The Principal Scientific Adviser
to the
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Towards a Better Future

