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Economic and Social Commission for Asia and the Pacific

CSAM



Conservation Agriculture (CA) in Federal Democratic Republic of Nepal

Presented by

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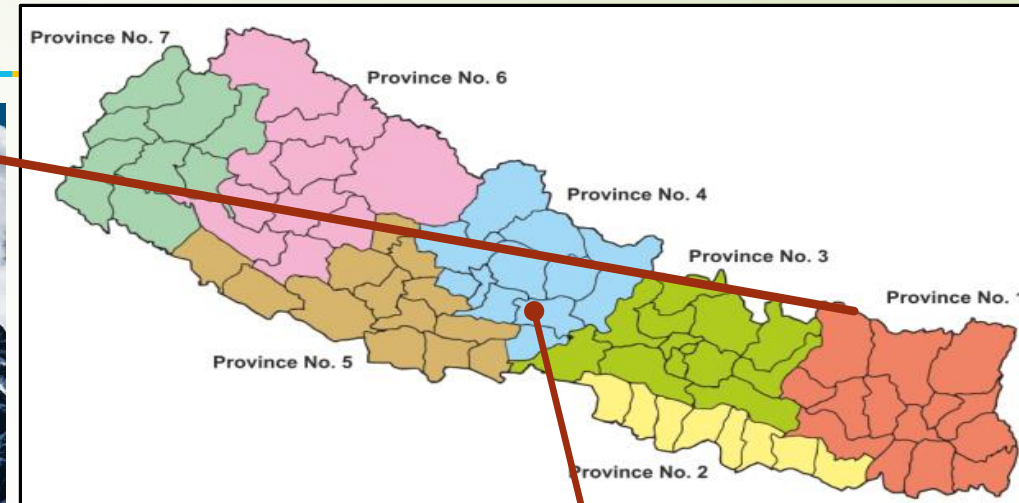
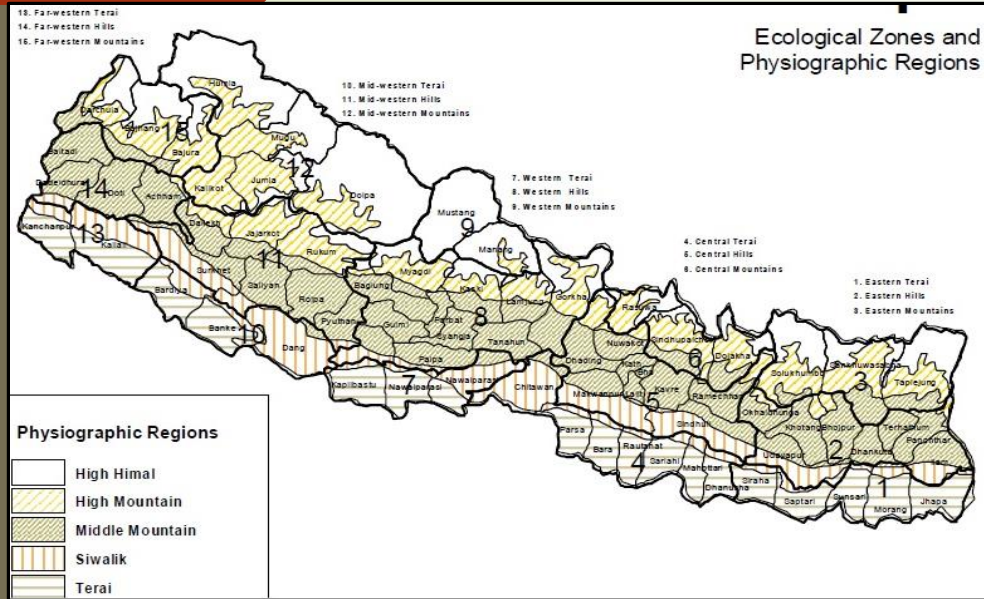
Program Director

Directorate of Agricultural Engineering

*Regional Workshop on the Role of Mechanization in Strengthening Smallholders' Resilience through Conservation Agriculture in Asia and the Pacific
18-20 April 2018, Phnom Penh, Cambodia*



Federal Democratic Republic of Nepal



- Total land area -147,181 sq. km, Only 0.1% of total land mass of earth (EW-885 km, NS-193 km)
- Three geographical region Terai, Hill & Mountain
- Elevation ranges from **70 m to 8848 m**
- Climate temperate to sub tropical
- Rugged terrain and diversity (in all sense) the typical feature

Nepal at a glance

- Predominantly an **agrarian country**
- Agriculture contributes 29.37 % to GDP, 66% employment
- 77 districts, 263 Municipalities, 3157 VDCs
- Population 28.98 millions, 10 religions
- 125 caste/ethnic groups, 123 languages spoken as mother tongue
- 25.2 % people still below poverty line as of 2010
- Global hunger index 22.2 as of 2015
- 21% of the land is cultivable (47% rain-fed)
- **Average land holding – 0.68 ha**
- **“feminization of agriculture”** has increased from 8 to 19 percent in the last 10 years (6th National Agriculture Census, 2013)
- Major crops Paddy, Maize, Wheat and Horticulture
- Livestock: Cattles, Buffaloes, Sheep/Goat, Pigs and Poultry

Overall baseline Problems of climate

Climatic characteristics varying from tropical to alpine conditions within a lateral span of less than 200km

- 4th most climate-vulnerable country in the world
- Climate change is altering the incidence, intensity and distribution of rainfall.
- Rise in the maximum temperatures at an annual rate of 0.04 – 0.06° C
- 64/77 districts prone to a variety of recurring natural disasters
 - floods, landslides, snow avalanches, GLOF, hailstorms, thunderstorms, cold waves, hot waves, drought, epidemics and earthquake
- 49/77 prone to floods and/or landslides
- 23/77 to wildfires, and 1/77 to windstorms

Risk affecting Agri Production-A Major Challenge

- Vagaries of weather

- Rainfall
- Temperature
- Humidity
- Wind
- Hailstorm



- Pest & diseases

- Fire

- Flood

- Quality of inputs

- Market prices



Climate Risks affecting Agri Production-A Major Challenge

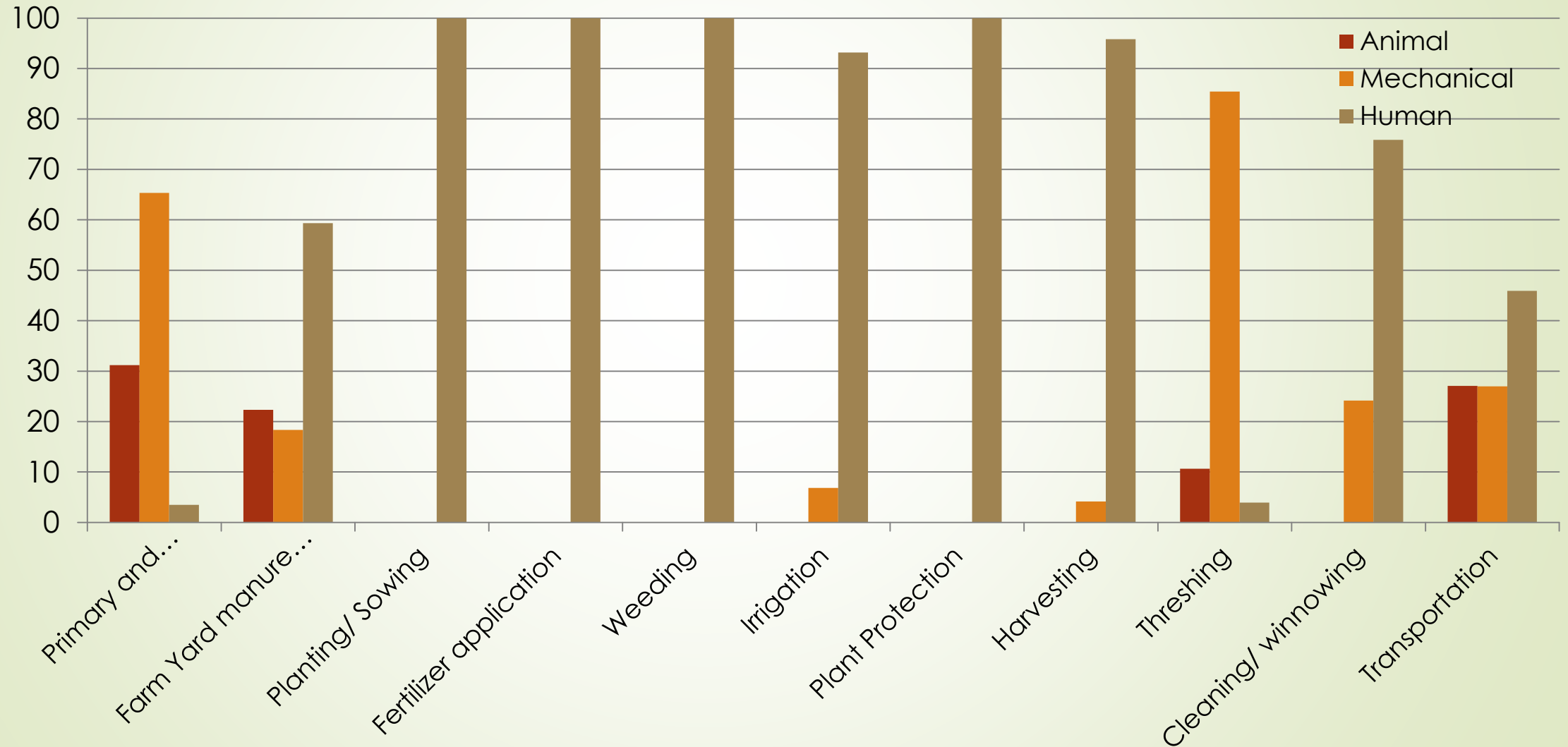
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The climate induced natural disaster causes **Loss of agricultural land & crop by climate related extreme events (1971-2007)**

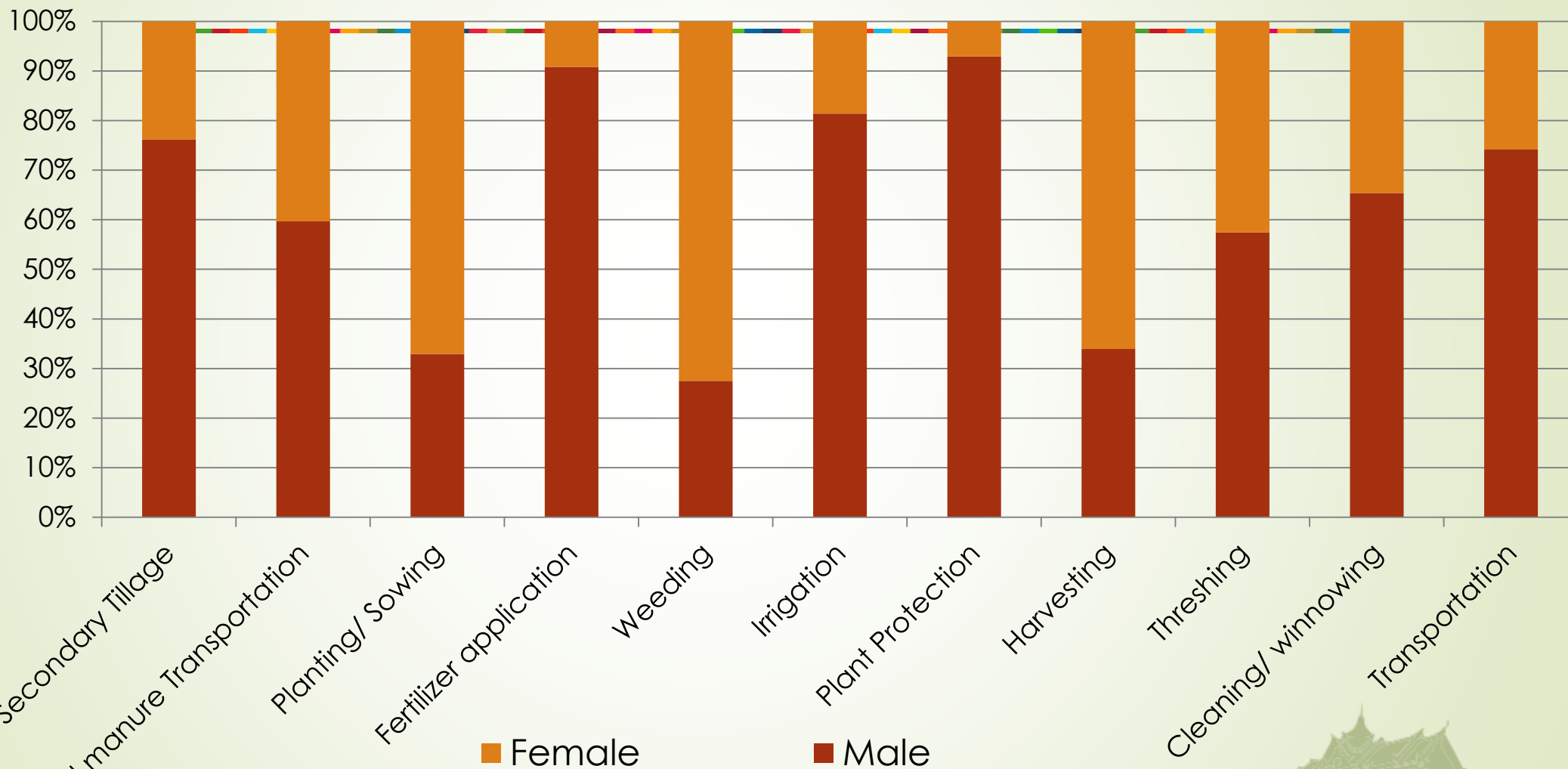
| Events | Loss of agricultural land & crop(ha) |
|--|--------------------------------------|
| Drought | 329,332 |
| Flood | 196,977 |
| Hail storm | 117,518 |
| Rains | 54,895 |
| Strong wind | 23,239 |
| Cold waves | 21,974 |
| Others (forest epidemic, snow storm, firestorm, thunderstorm, avalanche, plague etc) | 83,336 |
| Total | 847, 648 |

Source: Global assessment of risk ,Nepal Country Report, ISDR, Global assessment report on poverty and disaster risk,2009

Farm Power Used in Agricultural Operation in Terai



Gender-wise Farm Labour Involvement in Agricultural Operation in Terai



Trend of Agricultural Mechanization in 20 years

| Types of Equipments | 1991/92 | | 2001/02 | | 2011/12 | |
|---------------------|----------------------------------|---------------------|----------------------------------|---------------------|----------------------------------|---------------------|
| | Holdings using equipments ('000) | No. of items ('000) | Holdings using equipments ('000) | No. of items ('000) | Holdings using equipments ('000) | No. of items ('000) |
| Iron ploughs | 315.1 | 354.5 | 870.3 | 890.2 | 1073.4 | 856.3 |
| Power tillers | 5.6 | 1.6 | 15.6 | 11.8 | 75.7 | 10.4 |
| Shallow tube wells | 50.9 | 48.2 | 119.7 | 109.5 | 367.7 | 262.0 |
| Deep tube wells | 20.1 | 15.7 | 58.6 | 51.5 | 159.7 | 82.0 |
| Rower pumps | 3.5 | 3.8 | 22.7 | 21.8 | 79.1 | 36.2 |
| Tractors | 35.2 | 5.5 | 272.9 | 150.6 | 844.7 | 37.4 |
| Threshers | 85.6 | 19.9 | 249.5 | 129.1 | 803.1 | 51.9 |
| Pumping sets | 81.1 | 41.3 | 210.4 | 146.1 | 548.2 | 150.3 |
| Animal drawn cart | 204.6 | 198.1 | 226.4 | 199.1 | 335.0 | 159.9 |
| Sprayers | 50.2 | 23.4 | 203.0 | 145.9 | 574.0 | 282.3 |
| Others | 296.5 | 878.4 | 449.0 | 1072.7 | 290.1 | 83.5 |

Source: National Sample Census of Agriculture, CBS

Agricultural Machinery Import , 2016/17

| HS Code | Description | Unit | Quantity | Value in NPR '000 | Source Country |
|----------------------------|---|------|----------|-------------------|---|
| 87011010/87011090/87019000 | Tractor including Power Tiller | PCS | 38,896 | 11,451,192 | India, China |
| 84321000 | Ploughs | PCS | 18,946 | 20,386 | India, China |
| 84322100 | Disc harrows | PCS | 4,595 | 35,125 | India, UK |
| 84322900 | Harrows (excl disc harrows), scarifiers, cultivators, weeders, hoes including Mini Tiller | PCS | 221,151 | 1,070,647 | India, China, Indonesia |
| 84323000 | Seeders, planters and transplanters | PCS | 2,763 | 20,042 | India, China |
| 84328000 | Soil preparation/cultivation machinery; lawn/sports-ground rollers | PCS | 38,068 | 143,689 | India, China |
| 84332000 | Mowers (including cutter bars for tractor mounting) | PCS | 1,129 | 26,899 | India, China, Australia |
| 84334000 | Straw or fodder balers (including pick-up balers) | PCS | 677 | 9,095 | India, China |
| 84335100 | Combine harvester-threshers | PCS | 1,930 | 353,761 | India, China, Japan |
| 84335200 | Threshing machinery for agricultural produce | PCS | 21,933 | 654,189 | India, China, New Zealand, Turkey |
| 84335300 | Root or tuber harvesting machines | PCS | 2,711 | 23,855 | India, China |
| 84335900 | Harvesting machinery | PCS | 17,802 | 58,737 | India, China, Japan |
| 84361000 | Machinery for preparing animal feeding stuffs | PCS | 176,638 | 697,678 | India, China, Netherlands, Germany, Republic of Korea |
| 84362100 | Poultry incubators and brooders | PCS | 844,222 | 219,934 | India, China, UK, Malaysia |
| 84371000 | Machines for cleaning/sorting/grading seed grain or dried vegetables | PCS | 10,666 | 508,893 | India, China, Germany, Republic of Korea |

Source: website of Department of Customs (<http://www.customs.gov.np/en/newdata.html>)

Status of Conservation Agriculture (CA) and Crop Production

- ▶ Till date only about 11 percent of the world's arable and permanent cropland area is farmed under CA, and only 3 percent in Asia. **NO exact data under CA is available . But project wise information are available.**
- ▶ **Farmers has not yet readily adopted CA practices**

Area of Food Crops and their Production Details

| Crops | 2014/15 | | | 2015/16 | | | 2016/17 | | |
|------------------|------------|-----------------|----------------------|------------|-----------------|----------------------|------------|-----------------|----------------------|
| | Area (Ha.) | Production (MT) | Productivity (MT/Ha) | Area (Ha.) | Production (MT) | Productivity (MT/Ha) | Area (Ha.) | Production (MT) | Productivity (MT/Ha) |
| Paddy | 1425346 | 4788612 | 3.36 | 1362908 | 4299078 | 3.15 | 1552469 | 5230327 | 3.37 |
| | -4.14 | -5.12 | -1.02 | -4.38 | -10.22 | -6.11 | 13.91 | 21.66 | 6.81 |
| Maize/ Corn | 882395 | 2145291 | 2.43 | 891583 | 2231517 | 2.50 | 897789 | 2320000 | 2.58 |
| | -4.99 | -6.04 | -1.10 | 1.04 | 4.02 | 2.95 | 0.70 | 3.97 | 3.25 |
| Wheat | 762373 | 1975625 | 2.59 | 745823 | 1736849 | 2.33 | 750000 | 1841000 | 2.45 |
| | 1.05 | 4.91 | 3.82 | -2.17 | -12.09 | -10.14 | 0.56 | 6.00 | 5.41 |
| Total Food Crops | 3377036 | 9266240 | 2.74 | 3306323 | 8614287 | 2.61 | 3501192 | 9741665 | 2.78 |
| | -2.96 | -3.10 | -0.14 | -2.09 | -7.04 | -5.05 | 5.89 | 13.09 | 6.79 |

Source: Ministry of Agricultural Development

Policies and Strategies to promote CA and CA mechanization

The transformation process requires institutional and policy support. A conducive policy environment across agricultural, environmental and economic are very important factor for success

Constitution of Nepal 2072:

Article 51. **State policies:** The State shall pursue the following policies:

Section (e) Policies regarding agriculture and land reform:

Point (3) Protecting and promoting rights and interests of peasants and utilizing the land use policy for **increasing production and productivity of agriculture and for commercialization, industrialization, diversification and modernization of agriculture;**

Point (4) Making **proper utilization of land** through proper regulation and management on the basis of **productivity of land, its nature, and also by maintaining environmental balance**

Point (5) **Making arrangements for agricultural tools and an access to market with appropriate price for the produce.**

Section (h) Policies regarding the basic needs of citizens:

Point (12) Increasing investment in the agricultural sector by making necessary provisions for sustainable productivity, supply, storage and security, while making it easily available with effective distribution of food grains by **encouraging food productivity that suits the soil and climate conditions** of the country in accordance with the norms of food sovereignty.

Policies and Strategies to promote CA and CA mechanization

Agricultural Development Strategy (ADS)

20 years strategic planning 2015-2035

Vision

A self-reliant, sustainable, competitive, and inclusive agricultural sector that drives economic growth, and contributes to improved livelihoods and food and nutrition security leading to food sovereignty

4 STRATEGIC FRAMEWORK

4.4.1 Food and Nutrition Security

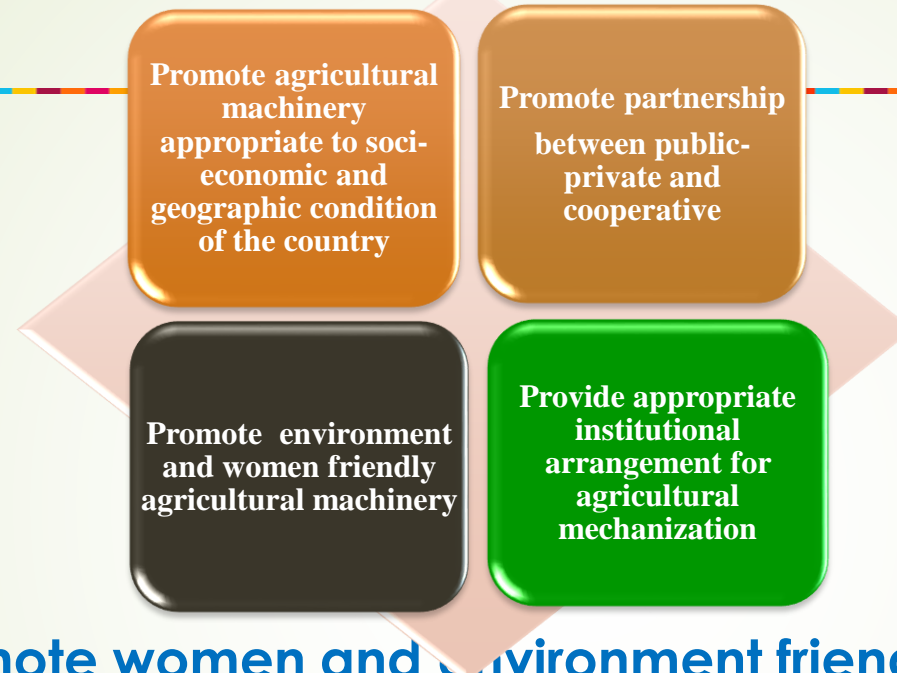
184. Component 2 of the ADS on Productivity has an impact of food and nutrition security by (i) increasing the volume of food production in Nepal in a sustainable way through higher productivity and sustainable use of natural resources; and (ii) reducing vulnerability of farmers through improved food/feed/seed reserves, **improved preparedness and response to emergencies, and climate smart agricultural practices.**

Policies and Strategies to promote CA and CA mechanization

Agricultural Mechanization Promotion Policy, 2071 (2014)

Approved on 29th August 2014

4 Main Objectives



- **To identify and promote women and environment friendly agriculture machineries.**
 - Promotion of environment friendly and fuel efficient machines will be encouraged
 - Promotion of agricultural machines appropriate for sustainable agriculture and resource conservation technology will be encouraged
 - Promotion of agricultural machines and equipments for production of organic fertilizer, organic and bio-pesticides and Integrated Pest Management (IPM), Integrated Nutrition Management (INM), Good Veterinary Practices (GVP), Good Livestock Practices (GLP), Good Agricultural Practices (GAP) and Good Fishery Practices will be encouraged

Policies and Strategies to promote CA and CA mechanization

Agricultural Mechanization Promotion Operational Strategy (AMP_OS)- under approval stage

- ▶ **Private sector led agricultural mechanization with optimal regulation and facilitation from the part of the government**
- ▶ **identified 38 activities and 105 sub-activities within 6 components**

Targets set for raising the level of Agricultural Mechanization

| Indicators and unit | Current status | Short-term (2017-2019) | Medium-term (2019-2022) | Long-term (2022-2027) |
|---------------------------------|---|------------------------|-------------------------|-----------------------|
| % of agricultural mechanization | 40% (Terai-61%, Mid-hill 15%, mountains-2%) | 50 | 60 | 70 |
| Power use in Kw/Ha (Mechanical) | 0.67 | 0.74 | 0.85 | 1.19 |

Source: AMP_OS study team report

Good Practices in adoption of CA and CA mechanization

Technology used in different agro ecological Zone

CA was introduced sometime around 1996-97

► Terai- (Plain Land)

- Minimum tillage (power tiller operated seed drill): for wheat, rice, lentil, mung bean etc.
- Zero-tillage (4 wheel tractor operated zero till machine): for wheat, rice, maize, rajma, lentil, mung gram, and peas etc
- Reduced tillage (Animal- drawn harrows, 4 WT harrows): for wheat
- Surface seeding / Relay seeding: for wheat, mung bean and lentil
- Bed planting: for wheat, rice , maize, mung bean
- Land Laser Leveler (LLL)
- Happy turbo seeder
- Manual seed broadcaster
- strip till maize and wheat
- DRS in rice



Good Practices in adoption of CA and CA mechanization

Technology used in different agro ecological Zone

► Mid Hill and Valley

- Promoting planting with supplementary irrigation, short-duration cultivars
- Minimum tillage using a strip-till, intercropping with leguminous crops,
- Use of cover crops
- Strip till maize and wheat
- Contour farming
- Terrace farming
- Seed Drills driven by power tiller and mini tiller
- Jab planter, hoe, etc

► High Hill

- Contour farming
- Terrace farming
- Seed Drills driven mini tiller
- Jab planter, hoe,



Good Practices in adoption of CA and CA mechanization

Government Organization in CA

Directorate of Agricultural Engineering (DoAEngg) - Department of Agriculture

- ▶ Establishment of Model Custom Hiring Services (CHS) Center
- ▶ Resource Conservation Technology (RCT) since Fiscal Year 2005/06
 - ▶ Demonstration of Power Tiller driven Seed cum Fertilizer seed drill
 - ▶ Validation with Traditional Practice side by side plot on wheat and rice
 - ▶ More than **30 location** of Terai and Mid Hill districts.
 - ▶ Average Result compare with traditional practice on wheat
 - ▶ Cost reduction by **30%**
 - ▶ Production increase by **25 %**
 - ▶ Net Income increase by **27.5%**



RCT



FARMER PRACTICE



Good Practices in adoption of CA and CA mechanization

Research Organization in CA

► Nepal Agriculture Research Council (NARC)

► Agricultural Engineering Division (AED) –

- Minimum Tillage by Power tiller driven seed cum fertilizer drill
- No-Tillage by 4-wheel tractor driven seed cum fertilizer drill & Happy seeder
- Residue Management
- Direct Seeded Rice
- Green Maturing
- Dry and wet welders



Good Practices in adoption of CA and CA mechanization

Research Organization in CA

► **Nepal Agriculture Research Council (NARC)**

► **Agricultural Engineering Division (AED) –**

► Developed Jab Seeder for maize and fertilizer – Has given license to Local manufacture- few years back **50 units exported to East Timor**

► **Manual seed-cumfertilizer jab planter for Maize** -lightweight (5 kg) and can seed more than 0.05 ha of land in an hour. It costs around Rs 7,000 (US\$70.25), and has following advantages:

- It can be used in untilled land;
- Residual moisture is conserved;
- Offers better germination; and
- Ensures increased fertilizer use efficiency.

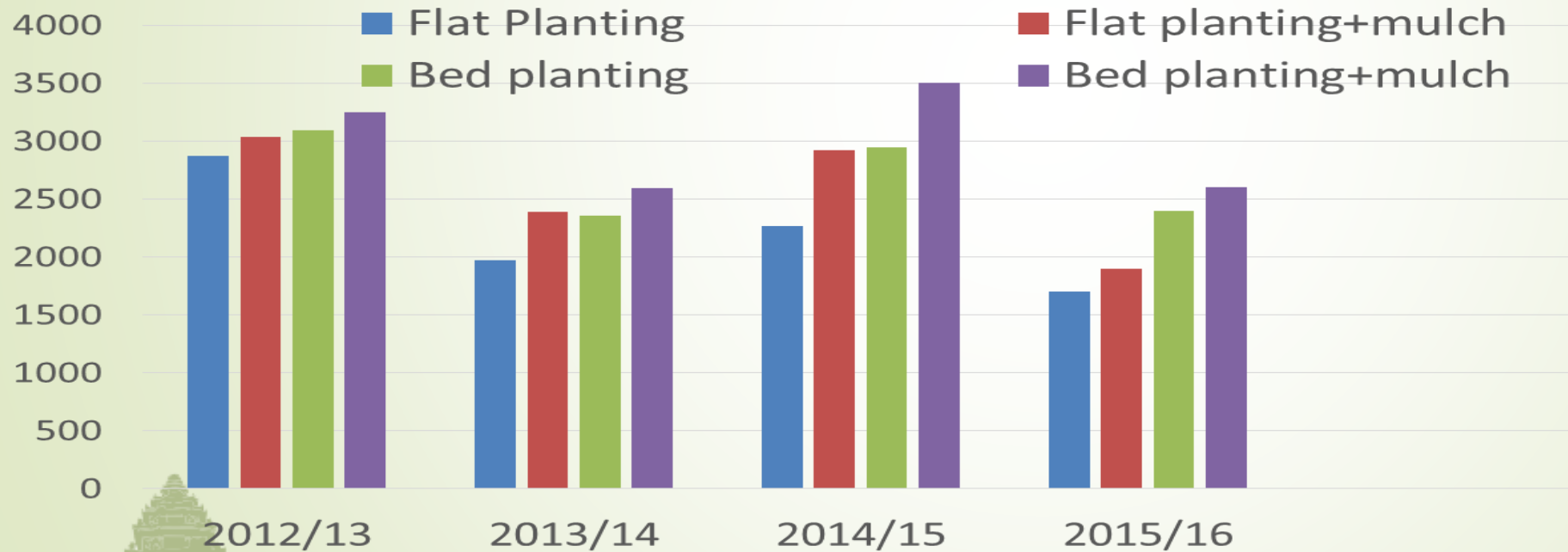


Good Practices in adoption of CA and CA mechanization

Research Organization in CA

- Nepal Agriculture Research Council (NARC)
- Agricultural Implement Research Station- Birjung- TERAI
- On Farm and out reach sites of Terai District on CA Practices

Example of On Farm-Wheat yield under permanent bed planting at AIRS, Parsa District (2012-2016)



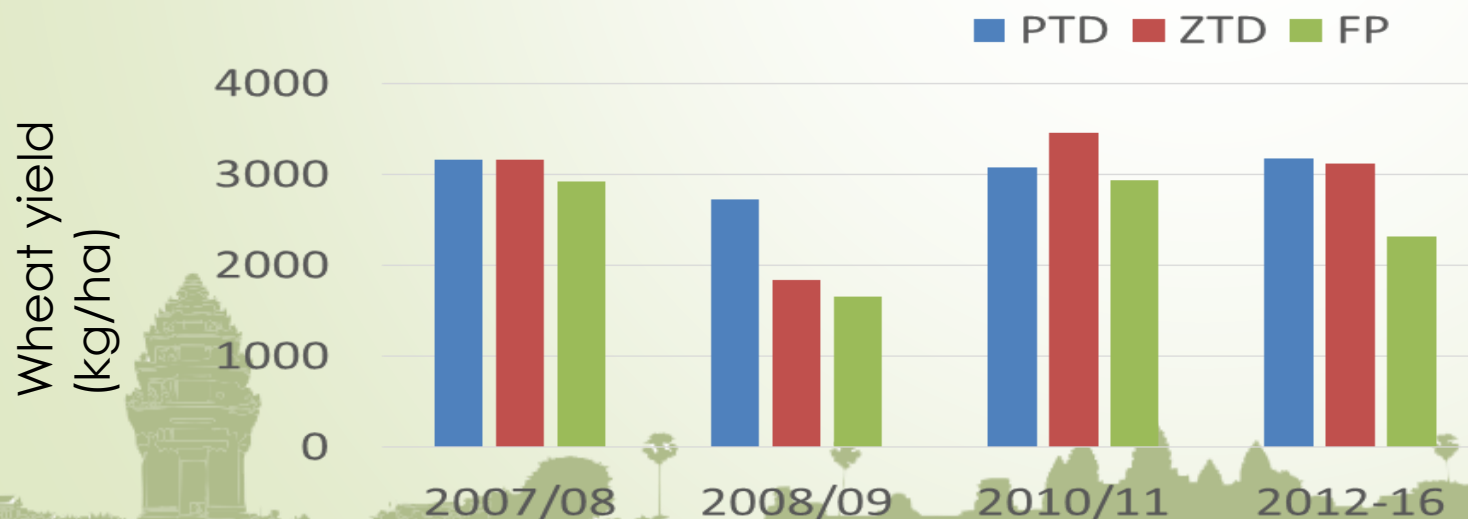
Good Practices in adoption of CA and CA mechanization

Research Organization in CA

Example of Out Reach Program by AIRS

Wheat area coverage (ha) under different CA practice in Parsa & Bara districts

| Year | PTD | ZTD | ADH |
|---------|-----|------|-----|
| 2007/08 | 192 | 133 | 56 |
| 2008/09 | 165 | 80 | 69 |
| 2009/10 | 4 | 139 | 458 |
| 2010/11 | 10 | 64.3 | 572 |
| 2012-16 | 31 | 133 | 134 |



PTD- Power till drill
 ZTD- Zero till drill
 ADH- Animal Drawn Harrow
 FP- Farmer's Practice

Good Practices in adoption of CA and CA mechanization

Research Organization in CA

Example of Out Reach Program by AIRS

Adoption of Laser Land leveling Technology

Wheat yield (kg ha⁻¹) under laser leveled and unlevelled field at AIRS, 2015/16

| | Laser Leveled | Unleveled | Water saving % |
|-----|---------------|-----------|----------------|
| PTD | 3112 | 2900 | 23 |
| ZTD | 3250 | 3025 | 38 |



Area under LLL

| Year | No of Beneficiaries | Area leveled (ha) | Remarks |
|-----------|---------------------|-------------------|------------|
| 2008/09 | 12 | 33 | Bara,Parsa |
| 2009/10 | 14 | 101 | Bara,Parsa |
| 2010/11 | 8 | 33 | Parsa |
| 2012-2016 | 31 | 77 | Parsa |

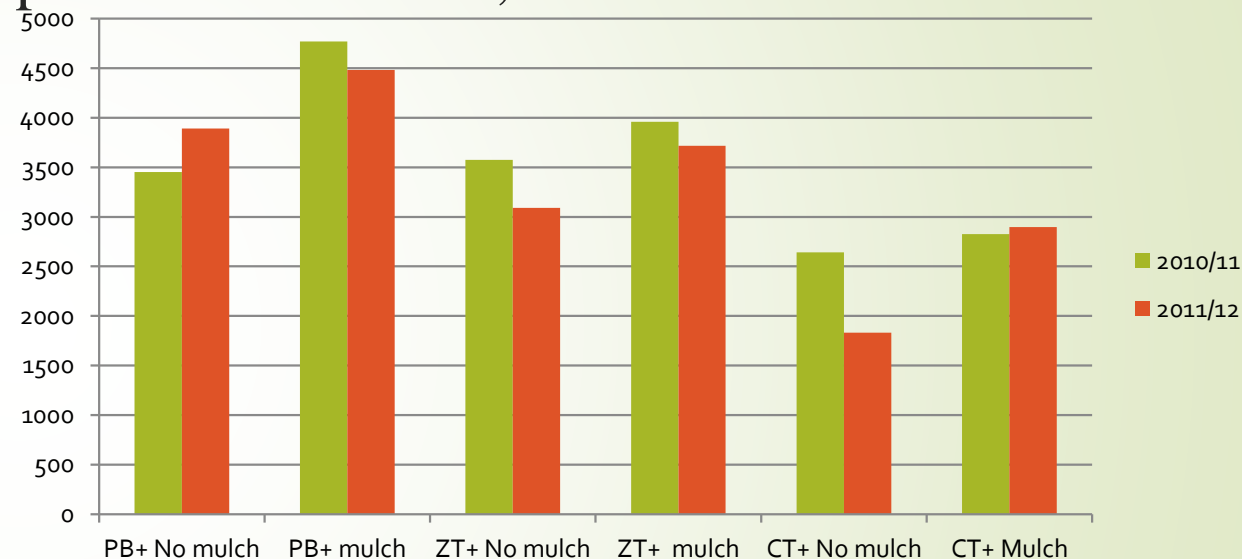
Good Practices in adoption of CA and CA mechanization

Research Organization in CA

National Maize Research Program (NMRP)

Maize yield (kg/ha) under different CA practices at NMRP, Chitwan

- Permanent bed (PB) with or without mulch saved about 29-33% irrigation water
- PB increased maize grain yield by 61-106%
- PB recorded highest (2.03) Irrigation water use efficiency



Good Practices in adoption of CA and CA mechanization

System of Rice Intensification (SRI) Experiences of Nepal

- Number of SRI farmers: about 6,000 of 30 districts
- Area under SRI: about 1,000 hectares
- Organizations involved:
 - Government agencies: DADOs, Irrigation Dept. offices, Poverty Alleviation Fund, NARC, etc.
 - Non-governmental organizations: ICIMOD, CSP/DFID, Care-Nepal, Li-BIRD, SAPROS, Surya Nepal, ATA, SAGOL, etc.
- Earlier maturity (17 days), less seed requirement (by 90%), less water requirement, less production cost, all with more yield (>60%)



Good Practices in adoption of CA and CA mechanization

Education Organization in CA

- ▶ Purbanchal Campus, Dharan under Institute of Engineering (IOE), TU
- 48 Agricultural Engineering graduates pass out each year
- Around 450 undergraduate Agril Engineers graduate till date.
- CA is taught in Agricultural Mechanization course

Private Sector in CA

Nepal Agriculture Machinery Entrepreneurs' Association

- Association of Manufacture, Fabricator, Importers, Dealers
- Import CA Machine
- Member of ReCAMA

Good Practices in adoption of CA and CA mechanization

Private Sector in CA

Custom Hiring Center (CHS)

- ▶ **Hakim Ansari, Kauwa Bankatya, Parsa**

Different types of Combine harvester, Tractor, Straw Chopper, Ridger, Cultivator, trolley etc.

- ▶ **Abhay Kumar Yadav, Bijabaniya, Parsa**

Tractor, Combine harvester, Laser land leveler, **Zero till drill**, reaper, rice transplanter, trolley



Good Practices in adoption of CA and CA mechanization

Private Sector in CA

Nemi Lal Sah, Sugauli, Parsa

Power Tiller Drawn Seed Drill

•**Mukund Bahadur Chhetri, Simara, Bara**

Tractor, Cultivator, **Zero-till Drill**, Disc harrow, Hadamba thresher of rice & wheat, trolly

•**Nawal Kishor Yadav, Pattarhati, Bara**

Tractor, Cultivator, **Zero-till Drill**, Disc harrow, Rotavator, Hadamba thresher of rice & wheat,

•**Rajeshwer Pd. Chaurasiya, Pakadiya, Bara**

Tractor, Cultivator, Disc harrow, Rotavator, Hadamba thresher of rice & wheat, Corn thresher, trolly



Good Practices in adoption of CA and CA mechanization

Development Organization in CA

- ▶ *FAO-Reducing Vulnerability and Increasing Adaptive Capacity to Respond to Impacts of Climate Change and Variability for Sustainable Livelihoods in Agriculture Sector in Nepal)*
 - ▶ *Climate Change Adaptation and Disaster Reduction Management*
 - ▶ *Period –September 2015 -August 2019*
- ▶ **4 districts-** Argakhanchi, Kapilbastu, Siraha and Udayapur
- ▶ Aim to strengthening institutional and technical capacities
 - ▶ for reducing vulnerability and promoting climate-resilient practices
 - ▶ Develop strategies and plans for effectively responding to the impacts of climate change and variability in agriculture sector
- ▶ a participatory learning and doing approach through farmer field schools
- ▶ Beneficiaries of the project are 120 farmer groups (3000 farmers-more than 60% women)
- ▶ **Community Based Adaptation (CBA)** to strengthen livelihood strategies and transfer of adaptation technology
- ▶ **20 Zero tillage seed drill had been used in last wheat season.**

Good Practices in adoption of CA and CA mechanization

Development Organization in CA

- ▶ **CEREAL SYSTEMS INITIATIVE FOR SOUTH ASIA** CSISA's Mechanization and Irrigation (MI) programs
 - ▶ **Mid and Far West** development regions terai and mid hill
 - ▶ Increase the adoption of **sustainable intensification technologies**
 - ▶ **Intensification and diversification** of pulses (lentil and mung bean)
 - ▶ **Promoting scale-appropriate mechanization and irrigation**
 - ▶ **Machine-sown dry direct seeded rice (DSR)** into non-puddled fields ,can also be practiced under **zero-tillage**
 - ▶ Produced a **FMradio jingle to spread awareness** of the benefits of DSR in Western, Mid-Western and Far Western Terai districts
 - ▶ Organize **linkage workshop among farmers, dealers, importers and public organizations** and **visit to zero tillage wheat , strip till lentil and DSR** by the new machinery
 - ▶ **More than 200 hectares** in the districts of **Rupandehi and Nawalparasi of Western Districts**
 - ▶ **More than 105 hectares** in the districts of **Banke and Bardiya of Mid-West Districts** during the monsoon season, a 90 percent increase over last year



Good Practices in adoption of CA and CA mechanization Development Organization in CA

Sustainable and resilient farming systems intensification (SRFSI) Project in the Eastern Gangetic Plains

- Regional four-years project (May 2014 - June 2018)
 - **India** (Malda, Cooch Behar, Madhubani and Purnea)
 - **Nepal** (Dhanusha and Sunsari)and
 - **Bangladesh** (Rajshahi and Rangpur)
- Collaborative between



Australian Centre for International Agricultural Research (ACIAR) and the International Maize and Wheat Improvement Center (CIMMYT)

- More than **20 partners representing research, development and educational sectors**
- OBJECTIVE: These partners are expected to answer two questions:
 - can farm management practices based on the principles of CA system intensification (CASI) increase smallholder crop productivity and resilience?
 - can institutional innovations that strengthen adaptive capacity and link farmers to markets and support services for both women and men farmers accelerate change processes

of the total beneficiaries (34,658), female farmers' participation was 31.9%

Good Practices in adoption of CA and CA mechanization

Development Organization in CA

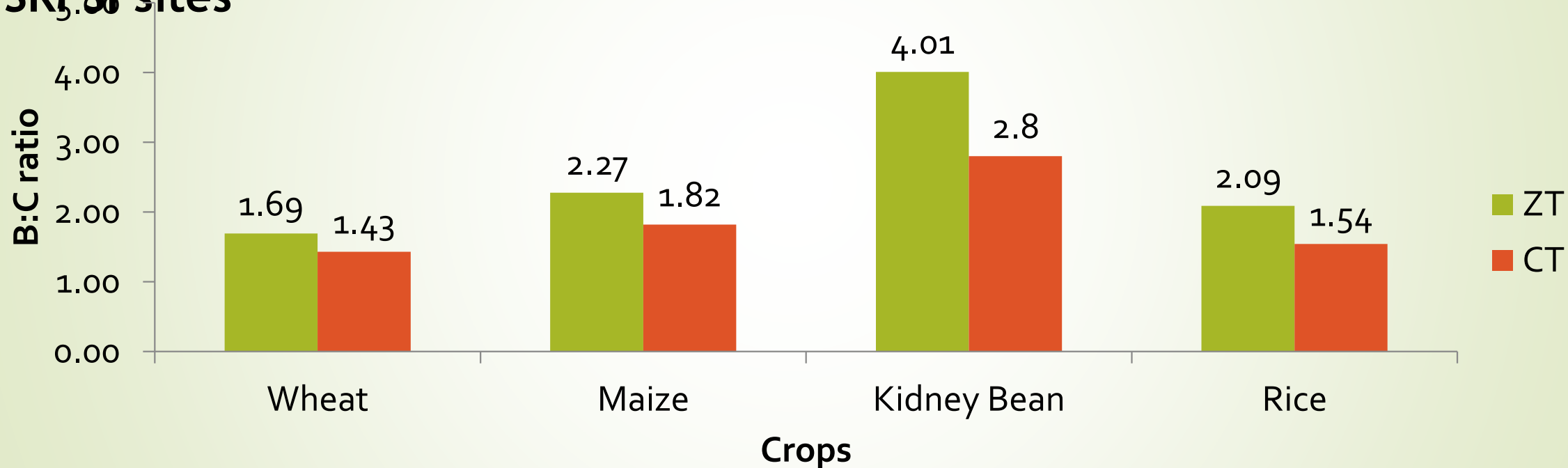
SRFSI sites



Good Practices in adoption of CA and CA mechanization

Development Organization in CA

B:C ratio comparison of CA adopted commodities in Sunsari district of SRFSI sites



Dhanusha

- Reduced cost of production in ZT DSR (26-72% less tillage cost, 10-21% less water) than TPR
- Cost of production reduced by 25-30 % in ZT Maize/Wheat than CT (35% less tillage cost, 14% less water)

Good Practices in adoption of CA and CA mechanization

Development Organization in CA

Out scaling Activities (2014-2016) of SRFSI

| SN | Crops/ Technology | Area Coverage (ha) | #Farmers benefited |
|----|-------------------------|--------------------|--------------------|
| 1 | ZT Wheat | 331.4 | 568 |
| 2 | ZT Maize | 132.9 | 170 |
| 3 | ZT DSR | 4.5 | 14 |
| 4 | UnP (Rice Transplanter) | 0.5 | 1 |
| 5 | MT Sunflower | 1.3 | 1 |
| 6 | ZT Fodder Grass | 2.7 | 2 |
| 7 | ZT Sponge Gourd | 0.5 | 1 |
| 8 | ZT Kidney bean | 2.0 | 7 |
| 9 | ZT Mung | 0.4 | 1 |
| 10 | ZT oat | 0.4 | 1 |
| 11 | ZT Bitter Gourd | 0.1 | 1 |
| 12 | LLL (Maize and Rice) | 9.0 | 9 |
| | Total | 485.7 | 776 |



5 ZT machine; 2 4WD tractor provided on subsidies to farmers
1 Land Laser Leveller in process

Good Practices in adoption of CA and CA mechanization

Study Work on CA

- **Implications of Conservation Agriculture for Men's and Women's Workloads Among Marginalized Farmers in the Central Middle Hills of Nepal** by [Jacqueline Halbrendt](#), [Aya Hirata Kimura](#), [Steven A. Gray](#), [Theodore Radovich](#), [Brinton Reed](#), and [Bir Bahadur Tamang](#)
- **Effect of conservation agriculture on maize-based farming system in the mid-hills of Nepal** by [Bikash Paudela*](#), [Theodore J.K. Radovichb](#), [Catherine Chan-Halbrendta](#), [Susan Crowa](#), [B.B. Tamangc](#), [Jacqueline Halbrendta](#) and [Keshab Thapa](#)
- **Economic analysis of conservation agriculture in maize--based farming system in Nepal** by [B Paudel*](#), [C Chan---Halbrendt](#), [G Norton](#), [A Nguema](#), [P Limbu](#), [T Radovich](#), [S Crow](#) & [J Halbrendt](#)
- **Studies on the Conservation Agriculture Based Practices Under Maize (Zea Mays L.) Based System in the Hills of Nepal** by [Tika Bahadur Karki](#), [Nirmal Gadai](#) and [Jiban Shrestha](#)



Constraints and challenges to adoption and promotion of CA and CA mechanization:

► Policy

- **Inconsistencies** in Government program support
- **Weak in multi-sectoral linkage** in coordination and cooperation
- **Land fragmentation**, and the **conversion of agricultural lands into other uses.**
- **Less governmental willingness** in financially supporting and promoting CA
- **Low levels of research funding** available for addressing CA issues.
- **Low public sector investment** in agriculture
- **No control of excessive use of fertilizers and pesticides**
- **Lack of Recognition** of Farm Machinery Custom Hiring Enterprise

► Environmental and agro ecology

- **Physical constraints of rugged and steep topography, narrow terraces** in Hills and Mountains discouraged use of machineries.
- **Less knowledge** about **suitability of different production methods under the climate change scenario** across a wide array of ecological
- **Limited capacity for adaptation to climate change effects**

Constraints and challenges to adoption and promotion of CA and CA mechanization:

► Socioeconomic

- Change over to CA requires a **change in mindset** as well as a whole range of new management approaches
- Food needs will rise due to the **increase in incomes of the people**
- **Produce more food and fiber per unit of area** to feed a growing population.
- Farmers' inability to take **risks and invest in new technologies**
- **Poor knowledge** of best agricultural management practices
- Competing uses of **crop residues mainly for animal fodder**
- **Subsistence farming, small farm size,**
- **External environmental issues** (produce markets, value addition, and climate change variability)

Constraints and challenges to adoption and promotion of CA and CA mechanization:

► Socioeconomic

- Enticing **commercialization of production** (farming as a business)
- Farmers are still **illiterate** or not skilled to make scientific observations, keep records and interpret the results
- **Gender constraints** are another major factor that we need to consider in CA promotion and adoption
- Farmers often **lack knowledge on safe and integrated weed management** practices (IWM)
- **Small and fragmented land holding**
- **Capital investment and financial**

Constraints and challenges to adoption and promotion of CA and CA mechanization:

► Technological

- small-scale farmers has been **limited to access to specialized equipment and machinery**, such as no-till planters
- **concept of CA** is relatively new and **constitutes a big departure from conventional practices**
- **unavailability of manual or bullock drawn portable machineries** for levelling land, sowing and harvesting crops in the sloppy terraces,
- **Need** appropriate machinery **for small-holders**
- **Knowledge intensive** as opposed to power intensive conventional farming
- **New ways of crop management**
- **Use of farm yard manure (FYM) and compost is the most difficult** task in practicing CA
- Requires **state-of-the-art technologies and technical know-how on non-chemical pest control and use of manures**
- **Availability of inputs**
- **Less capacity of local agricultural machinery fabricators**

Constraints and challenges to adoption and promotion of CA and CA mechanization:

► Institutional

- Less skilled human resources
- Lack of access to information and updates
- Poor Ag. Machinery Extension System:
- Poor Ag. Machinery Research System:
- Lack of Awareness of Improved Ag. Machinery for CA

► General

- Very time-consuming, and measurement is often ambiguous
- Crop diversification, crop rotation, mulching, organic recycling and soil-water conservation require 5 to 10 years of implementation before the results are visible or measurable
- without solving the problems of poverty and population pressure on the land is impossible to adopt CA
- Smallholders having marginal lands

Recommendations

- A shift to the approach of CA often **involves combining traditional wisdom with modern technology** that is acceptable, adoptable, profitable and environment-friendly
- CA should **survive in the changing climate and work with nature's biological cycle**
- Generating knowledge through **on-station research and verification through wide-scale participatory research in farmer's fields** are the basic pathways of promoting CA based practices
- Developing **effective linkages and working in partnership with a range of stakeholders**, including private machinery manufacturers, agrovets, and development officials is the key to accelerated generation and adoption of CA practices
- **Three principles:** 1. Minimum soil disturbance. eg. zero tillage 2. Year-round soil cover. eg. maintaining crop residues on soil surfaces. 3. Crop rotation. eg. agroforestry. These principles, when **adopted together with appropriate land preparation (precision leveling using laser equipment, planting in bed and furrow systems, etc.)** form the basis for a shift from conventional to conservation agriculture
- **Need champions/role models to Change of mindset of Farmer**
- **Crop-livestock integration, to keep the Crop residues for soil covered**

Recommendations

- **Researching & contextualizing options for weed control**
- Adaption of CA to **suit local conditions and needs**
- **Reduced tillage** could be an option to tackle **Conventional tillage practices on steep and fragile landscape**, which can **check fertility depletion and significant loss of top soil of the Himalayan hills.**
- **Farmer Field School (FFS) is a participatory approach to educating and empowering farmers.**
- FFS has been successful in **disseminating information, handing over technology and fostering CA**
- Wide acceptance of CA will **require governmental support to the farmers not only in the beginning to sustainability but also in maintaining it once it has been achieved.**
- **Not only subsidising inputs but formulation and implementation of policies that instigate farmers towards the trajectory of CA confidently.**
- **Investing in women and empowering them through new techniques and access** to agricultural inputs is essential to yield better incomes and improved quality of life for rural families

Recommendations

About 4-7 % of revenue have to sacrifice for more than 5 years to adopt CA, Hence, Government should Subsidies CA technologies for adoption.

► Regional Level

- Technology transfer
- Exchange of commercially available equipment.
- Study visits for planners/scientists/technical officers in regional countries
- Exchange of information and publications
- Skill development training for existing man power
- Joint Action Research Project Development
- Strengthening R & D Institutes
- Collaboration with national and international institutions for technology transfer

Conclusion

There is a strong need for a working group to advocate CA and its three pillars, and to work with farmers, scientists and private actors to enhance to better share information and results in order to scale up adoption of CA.

Hence

ASIAN ALLIANCE on CONSERVATION AGRICULTURE (CA) or SO

Is

NEEDED



wGoafb Thank You