

AGRICULTURE

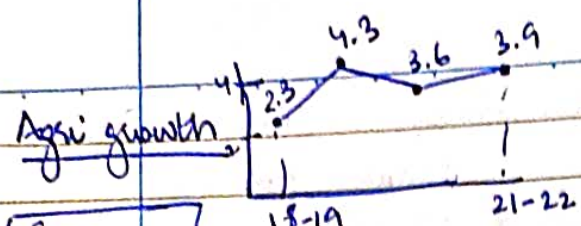
Smriti Mishra

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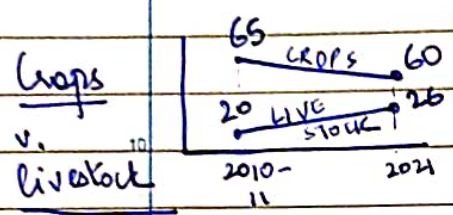
2021	Land reforms*	DS Notes
	Meso Irrigation •	1. Natural farming
	Crop diversification + tech -	2. MSP
	NESA ?	3. Buffer stock, FCI
2020	Agri transport + marketing	4. Animal rearing
	Food processing •	5. Data ✓
	Rice wheat system why success ? (15) -	
	Water storage & irrigation •	To do
2019	Integrated Farming System ?	
	National Watershed Project	
	M. S. Swaminathan	
	PDS	
	Food processing - challenges •	
2018	MSP + low income way	
	Supermarkets in supply chain management	
	Organic farming ?	
	National Horticultural Mission	
	Change in cropping pattern + millets -	
2017	Agri - revolution → how poverty alleviation	
	Food processing units •	
	Crop diversification -	
	? Subsidies affect cropping pattern & crop diversity ? ^{crop} insurance?	
2016	Water use efficiency → microirrigation •	
	Land reforms & agriculture *	
	Allopathy	
2015	Price subsidy → DBT ?	
	Contract Farming & land leasing *	
	Livestock rearing	
	Marketing & supply chain Agri	

- 85% farmers are small & marginal
- Food subsidy : 2.42 lakh crore



Grew even during the pandemic

- 52% raised
- 43% people employed
- 16% share in GDP (1951-51%)



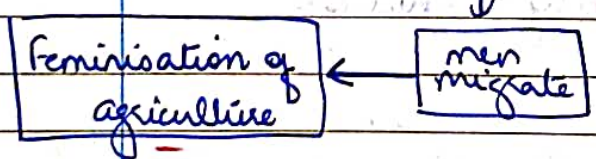
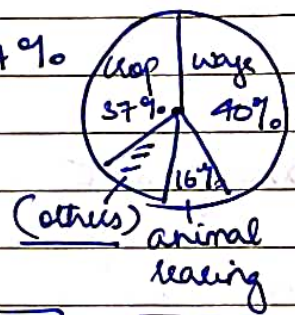
LIVESTOCK

- 4% to GDP; 25% to agri GDP
- 16% of farmer's income
- 70% of total agri employment
- 80% of business less productive
- 4.6% CAGR
- 2nd largest milk producer
- largest no. of cattle in the world

Subsistence model

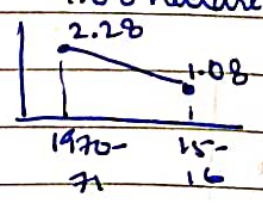
Natural Situational Assessment Survey

Crop revenue : 37%
Wage 40%
Livestock 16%



Monthly income = ₹ 10,218 (≡ MGNREGA)
52% households in debt

- Size of holding : 1.08 hectare (2015-16)
- Area under farming
- India : 189 mha
- China : 16135
- U.S - 160



Fragmentation ↓
productivity ↓
income ↓

FOOD PROCESSING

Smriti Mishra

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Data

253 designated food parks
India is world's 2nd largest
producer of food fruits & vegetables
but only 2% produce is
processed.

Mega food parks

Farmers
Groups

Individual
Farmers

SNAs

Collection centers

Primary processing
center

Mega
Food
Park

Value added
product
↓
Export

Fresh
product

Direct
Sale

Largest no. of livestock
L 1% meat → Value added
Products

40% global food processing
L US, UK, Canada

Horticulture : 16% net sown area

3rd million metric tonne

> food grains since 2012-13

33% to agri GDP

Livestock : 30% to agri GDP

Dairy : #47 in exports

Employs 1.43 million population

19 lacs

Eg ⇒ Tamil Nadu : own policy

90% cold storages store potatoes

Benefits

- Farmer

- Consumers

1. Employment:

d. doubling

farmer income : value
addition

3. distress migration / sale

more choice
food inflation
in control
Safar

bridge b/w
agri &
marketing

Policy

100% FDI allowed automatic

Ministry of food processing

Agro export zones

Mega Food Parks - PM SAMPADA

Draft National FP Policy 2017

to position India as
preferred invest. destination

Scheme for formalisation of
FP Enterprise

PLI scheme for food products

APEDA

Food security

Reduce malnutrition

Bharatya Poshan Krishi Kosh

Reduce wastage

40% waste (FAO)

90,000 crore (NDI)

Economy

value of agri exp ↑

Foreign eg: Basmati

Income realisation

Constraints

Farm levels

- Quality of inputs
- Extensive use of fertilisers & pesticides (only 4.2% biopesticide)

66 pests under review
"Pesticide treadmill"

- Unavailability of handling & transport system
- Intra bottle necks

Consumers

- No value for money products
↳ only packages
- Awareness low

Distributor level

- Cold storage (90% potato)
- Transport, road quality
- Irregular quantity & quality of farm produce (sorting)
- Bureaucratic hurdles in inter-state trade

Processing industries

- Financing, advertising costs
- Credit availability
- Only primary processing done
↳ low value added
- Limited domestic market
- Skilled manpower & (agri scientist)
- 75% unorganised
↳ 80% family based

MEASURES

1. Downward & upward linkage
eg: quality of agri produce
contract farming

2. Skilling + manpower
Agri scientists

3. Crop diversification

4. Standing committee on Agri 2018

↳ Dist level - constitute body

chair coordination & monitoring
committee

5. Committee on Doubling Farmer's income

↳ Kisan rail; upgrade logistics

↳ estb processing & value

addition units

fisheries

pulses
fruits
dairy

PPP

6. Encourage organised retail

eg: Dominos Pizza; logistics (P) ✓

7. Further liberalise including

eg: JV → Starbucks

Starbucks

IRRIGATION

Intro

Agriculture consumes 90% of India's freshwater

Data

52% rainfed

48% irrigated
(Monsoon)

canal 30%

tube well 60%

tank 5%

-ves

- limited area can be irrigated
- GW level falling
- Soil salinisation
eg: Punjab

Rainfed agri: 50% rural
workforce
60% livestock here

CANAL

Nareo = only 9 mha / 140 mha

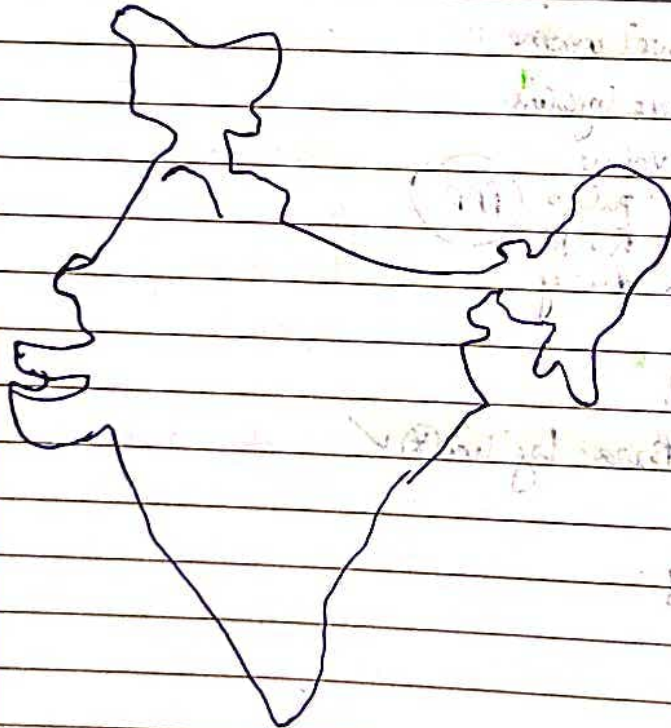
Input: 40% total input cost

Productivity: 1.1 ton / ha vs 2.8 ton / ha irrigated

where - low level relief,
deep fertile soil,
perennial source of water,
extensive command
area

Definition artificial application of water
to facilitate growth of
crops in an agricultural field.

Types → Inundation: no
regulating
systems at
head
Perennial: barrage
across river



+ves

- perennial irrigation
- as & when needed
- saves from drought

-ve

- excess water → flooding
- Plain areas only
cannot be dug
in rocky areas

Tube Well: Ground water availability

UP, Haryana, Punjab, Bihar, Guj

+ve - cheap, simple, independent
- as & when necessary

- GW minerals add fertility to soil
- Reliable during drought

Vaidyanathan committee

- pricing of water gradid
- water rate structure
- operation & maintenance

TANK

K'taka plateau, MP, Maharashtra,
Odisha, Kerala, Bundelkhand

area

-ve

tre

natural

cheap

long life span

fishing ✓

dig up

lift = strenuous
exerciseMicroirrigation

+ves:

1. WUE ↑ 50-90%
2. Energy efficiency: up to 50% savings
 ↳ low pressure reqd
 ↳ solar pumps can help
3. ↑ productivity of fruits
 veg - 52%
4. Cost saving
5. Inter cropping, multi cropping
6. Fertilization

MICRO IRRIGATIONIrrigation problems

1. Water scarcity: 52% rainfed
2. Regional variation in monsoon
3. Low water use efficiency (*)
7. Degraded land / cultivation

38%

2-4 times more than

China, Brazil

Virtual water exports

↳ 1kg rice → 2500L water

4. Depleting groundwater levels

5. Soil salinisation

Types1. Drip Irrigation

- H₂O applied near plant
roots through

emitters or drippers

- on/below soil surface

- 2-20 L/hour

Solution

1. Expand area under irrigation
 ↳ Has Khat me land

2. Focus on rainfed areas

eg. ₹ 2600 cr Budget 2019

3. Water harvesting

7. Night irrigation

5. Revise cropping pattern: SRI

6. Water Use Associations: Pariscanti

7. Accelerated Irrigation Benefit Prog

2. Sprinkler

- water sprayed into air,
allowed to fall like

rain fall

- pressure: nozzles → spray

- used for
wreven lands

Steps

1. PM Kishu Sinchai Yojna
2. Watershed Management

Measures

1. Farmer education
2. MG NREGA funds
↳ as in Bundelkhand

NWRDA (XI FYP)

- Objectives : productivity, restoration eco.
- reduction in disparity employment

- Activities

- ↳ Treatment : afforestation, pasture development
- ↳ cropping techniques
- ↳ Alternate land use : ploughing of steep slopes, reduce erosion
- ↳ Development of water resources
- ↳ Recharge of GW

Per drop more crop :

AGRI MARKETING

Need : Price discovery
rationalisation
intermediaries &

Date :

Data - Farmers get only 25% of what consumers pay

Steps

- Colours phenomena

- ₹90,000 crore food grain wastage

Model APMC Act 2003

- Aim : DCP

- Regulation
competitiveness

Private sector investment

- Provision :

1. Single pt of entry

2. Parallel markets + purchase centre
↳ direct sale to consumers

3. Separate market for perishable & farm veg

4. PPP encouraged

5. Promote contract farming

Issues APMC

RMBCIF → Restrictions on selling outside

mandis : competition &

- local political elites

- APMC members = agents

→ Monopolistic

- Restrains from higher bidding

low buying price higher selling price

- intermediaries

- cartelisation : Farmer's share

reduced (15-40%)

→ Cost multiplication : artificial

- licence fee

- Taxes

- commission

- market fee

Inflation

Model Agri Produce & Livestock Marketing

Act 2017

1. State = single market

↳ no restrictions

agri horticulture livestock

single fee

single licence

cap on market fee 2%

food grains 1%

→ Infra inadequate

↳ 10% APMCs have cold

storage

↳ 1/3rd : grading, sorting

facilities

2. Disintermediation

↳ direct interface

private wholesale

3. e-trading & national market

4. Market yard of national unavailability

5. Regulatory power = Director

Agri Marketing

→ Market fragmentation

↳ distortion, ↓ competition,

↑ logistics cost

Committee on Agri Reform 2013

: Barrier free national market

Issues

- State subject, voluntary implementation
 - ↳ Maha implement → withdrawal (strike)
- APMC → charged high fees, no land granted
- Ignores commission agent's role in APMC
- no mechanism to prevent hoarding

Hric Farmer Produce Trade & Commerce (P&F) Act 2020 → repealed

- ↳ agri market outside mandi
- ↳ remove barriers through inter state trade

Facts

- ↳ 60% agri trade outside mandi through unregulated sale ✓

FAPAFS Farmer (Empowerment & Protection) Agreement on Price Assurance & Farm Services Act 2020

- contract farming

Issue

- federal structure
- private sector + +
- Bihar — put unregulated market

ECA — Essential Commodities Act

Aim: hoarding & price fluctuation & control inflation

AGRI EXPORT POLICY 2018

Aim

- 2x Farmer income } by 2022
 2x Agri exports }
 Make India global leader

Operational

1. Cluster based approach
2. Value addition - AMUL
3. Brand India - GI
4. Quality segment
 ↳ deal c SPS
5. Private investments
 ↳ agri startups, fnd
 ↳ R & D in F&P
 ↳ SAC

Need

- ✓ Export < Thailand, Indonesia
 ↳ lesser agri land

low volume

- ✓ Total agri basket - 2% agri trade

low value

- ✓ Export - low value < low
 semi processed } 78.5%

- ✓ High value agri product
 export share = 15%

US - 25%, China: 49%

Policy

Targets

- 30 bn → 460+ bn by 2022
 ↳ reach 100 in next few yrs
- Diversify export basket
- boost high value agri exports
- institutional mechanism
 ↳ SPS barriers DGTR

Recom

Strategic

Policy

- stable regime, least restrictions
- Reform AP MC, ↓ mandi tax, remove perishables
- Insti mechs @ Union, state, cluster → promote exports
- Involve KVKs
- encourage private

Infra

- handling, storage
- integrated cold chain
- identify imp clusters

- dedicated exit point at port
- 24x7 custom clearance for perishables

link with RoRo services

Camlin

Integrated Farming = Agri + livestock
 poultry
 fish
 beekeeping
 sericulture
 agroforestry

In addition to agriculture

eg. Azolla production → fodder
 fertiliser
 (Use livestock to Notes)

LOAN AGRI SUBSIDIES

loan waivers (concepts)

Data 2.25% of GDP

1.2 lakh crore ₹ 2.42 Lcr

Fertilisers: ~~70,000~~ crore 79,530

Credit: 20,000 crore

Need

- structural reforms in agri
- Dalwai committee
- ↳ 2x farmer income

Issue

1. Not inclusive: rich farmers benefited more

2. Not sustainable

3. Distortions

↳ lower subsidy - Discom

↳ cropping patterns unsustainable

4. MSP hurts overall economy

↳ public investment
 ↳ crowding out

6. Bene:

Fertilisers

Data

usage

Ideal NPK

4:2:1

India

$\frac{9}{8} : \frac{4}{3} : 1$

⇒ Declining use of organic manure

- canalisation of input
 - subsidy diversion
 - ↳ 35% reaches beneficiaries only
- black market oligopoly

Leads to

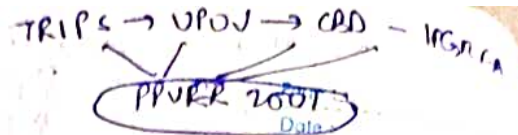
9 urea usage

leads to soil & GW contamination → low prod → low income

bio-diversity → eutrophication

Micro-nutrient deficiency

no input dependence



Solutions

- Being used under NBS
- Decentralise imports
- NBS, Soil Health card
- DBTisation of subsidy
- Organic farming, ZBNF
- Farmer edu
- Allied services (Extension)

PESTICIDES

- Data
- Only 4.2% total: biopesticides
 - CB under review + Anup Verma comm
 - Insecticides Act
 - 4th largest producer of pesticides
 - Use: $\text{NH} > \text{UP} > \text{PA}$ & Karnataka
 - Paddy > cotton

- 15-20% losses

- "Pesticide trap" / Threadmill

Issues - Health of: endosulfan poisoning in Karagad

- Environment "Pesticide threadmill"

- Residue: fat soluble tissue

- 4.2% biopesticide only

- Lack of access to tech

drift nozzle
spray shields

- Bioaccumulation

Soln

- Pesticide Management Bill 2020
- Integrated Pest Management
- Awareness
- Organic farming
- ZBNF
- "Pesticide Action Network"

SEED

Data: poor Quality accounts to 20-25% crop production

Issues: poor seed replacement ratio (20%)

- dependent on imports

- subdued private investment due to

cap on pricing

IPR issues

(eg: days potato case)

- Poor L&D

Soln: 1. Seed Village Banks

2. Inpa

3. P. Extension part

4. Regulation

5. 3P Quality certifica

6. T.R.V.D

Corel: Net seed exporter

Drage seed bill: aim

Issue

- compulsory registration of seed
- benefit sharing
- re-regulating allowed
- seed prices
- compensation diluted

decides as per CFA 2011

crop techniques
soil — | — aid

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PPVRA & Pesticide

Technology in Agri

① Biotech

1. GM crops — Yield
pest resistance

— Bt cotton: ↓ insecticide
— Ht BT by 75% in Andhra
— glyphosate

— DMH 11 — cross pollination

② Machine — sowing farming — stalks and

③ bio remediation

② IT & SB

2. Precision farming: drones, marketing

②

3. System of Rice intensification

↳ ↑ production by 30-35%
ex: TN, Bihar, Tripura

③

4. GIS mapping

5. Soil testing — soil health cards

6. Resource conservation

↳ zero tillage
raised bed plantations

④ AI — weather modelling, pest control

eg Personalised sowing app — Micro crops
KISAT

eg Soil sensors

Plantix — nutritional deficit in soil

⑤ Nanotech

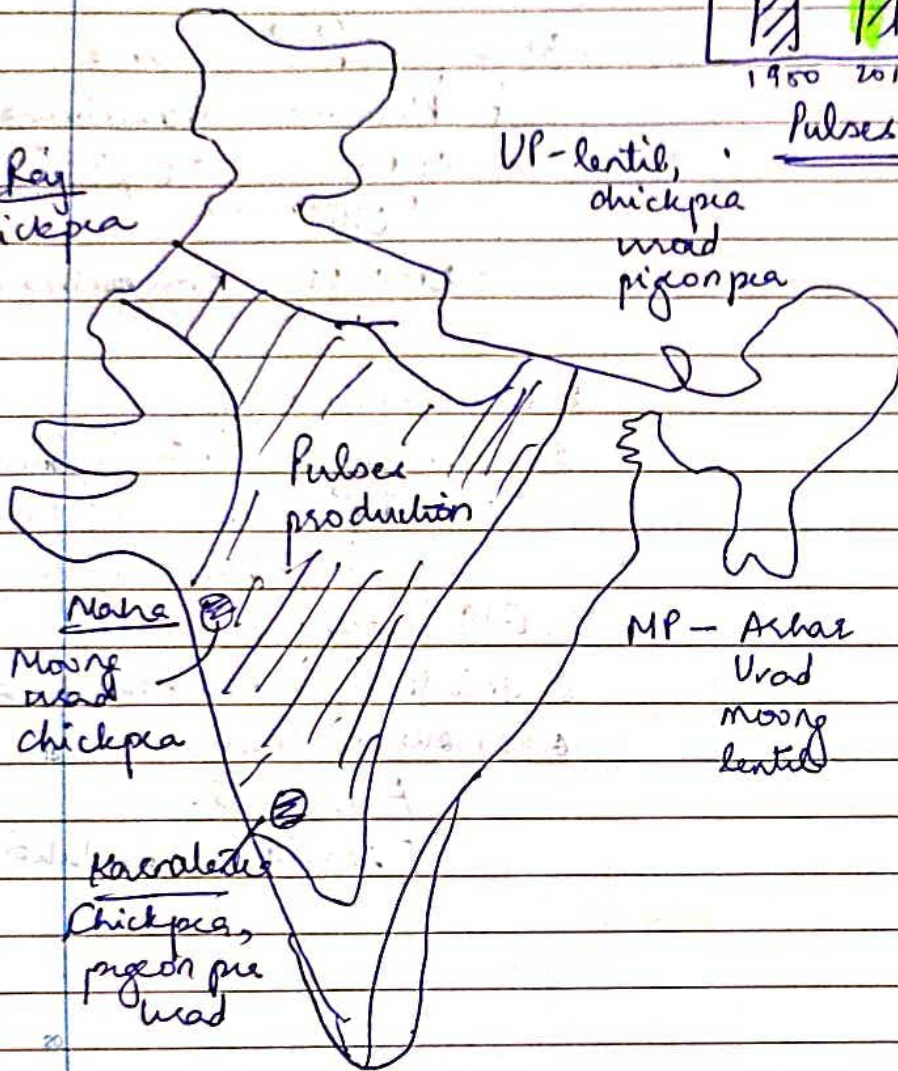
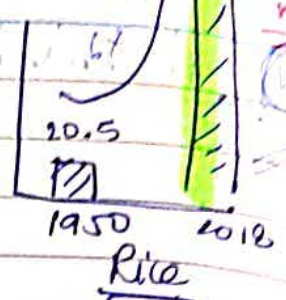
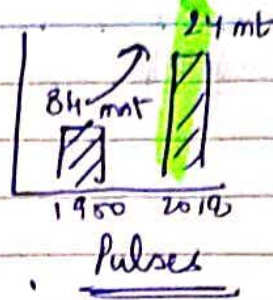
↳ Nano fertilisers

eg Nano urea by ICRISAT

Smriti Mishra

Camlin

PULSES

Ray
ChickpeaUP - lentil,
chickpea
moong
pigeon pea

India
largest
producer 25%,
consumer 27%,
import 14%

Issues

- MSP distorts cropping pattern
- Climate change
- HYV seeds / poor seed replacement rate
- High salinity in soil
- poor drainage
↳ UP, MP, Bengal

Potential

→ wide range of climate & soil

↳ India - 15 agroclimatic zones

- Huge domestic demand - primary supplement of proteins (1kg pulse < 1kg meat)
- Climate resilient
- Add N₂ to soil → ↓ need for fertiliser → ↓ NO₂ emissions
- less water required
- Mostly grown by small & marginal farmers
↳ growth of pulses → multiplier effect on removal of poverty & inequality

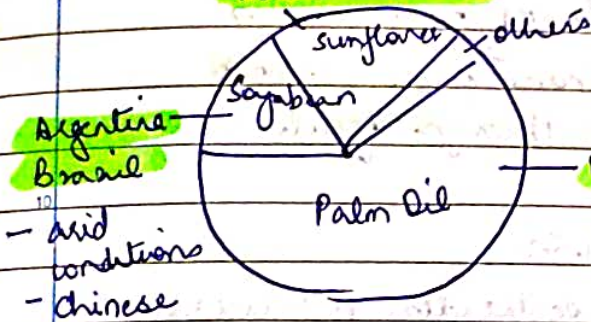
OIL SEEDS

Data 13 million tonne gap
56% imports (mostly palm oil)

Annual oil consumption = 24 m

Import bill = ₹ 1.17 lac (latest)

Consumption & Import basket
Russia & Ukraine



- acid conditions
- Chinese

Issue: - climate

- domestic biofuel

- labour shortage

Domestic production

Mustard > soyabean > groundnut > cottonseed > Rice bran
31.37 lakh tonne 20.66 23.16 12.26 10.68

NMDC - notes

- CSS (80:20)

- focus on NG + A & N

- Viability Gap funded

- ₹ 8844 cr budget for centre

Ann: 6.5 lakh ha by 2025

11.2 lakh tonnes

RICE-WHEAT / CEREAL CENTRICITY

Date R-W system covers 9.2 million hectare
 Rice = 43.8 mha → 177.6 mt production
 wheat = 29.3 mha → 103.6 mt production

Agriculture responsible for 16% of India's GHG

↳ 74% - methane from livestock

↳ 26% - NO through fertilisers

↳ Rice fields

Access - Policy support - Green revolution
 - Technology - HYV seeds, pesticides, fertilisers
 - MSP policy
 - Staple diet
 - major source of carbohydrate in diet

Issues

1. Cereal centricity → micronutrient deficiency

2. Distorted cropping patterns (MSP)

3. Environment - GW depletion

↳ soil salinisation

↳ methane emission

↳ stubble burning → [air pollution]

4. Govt intervention (regulated markets) → stagnation of growth (2-4%)
 Poultry ≈ 10%

5. Low productivity

↳ cereal yield = 3282 kg / hectare

land holding 1.68 ha

china

6296

0.6 hectare

AGRI STORAGE + TRANSPORT

Smriti Mishra

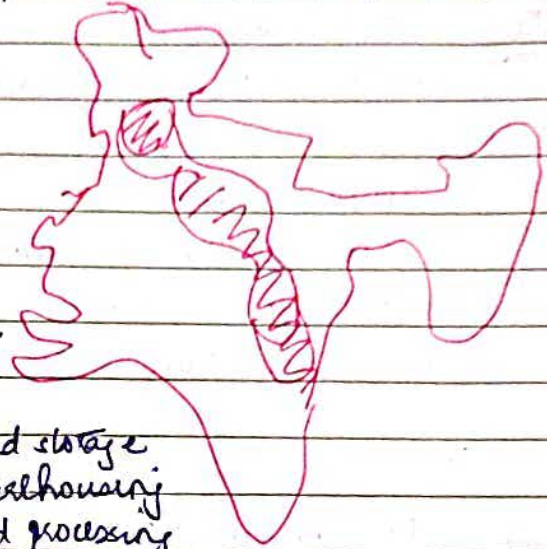
use pts from food processing

Data - 64% storage capacity concentrated in Punjab, Haryana, Andhra, UP, Chhattisgarh

- 90% cold storage → potato

- Transport

↳ 97% road
↳ 29% from rail } need to change



Issue

- Lack of enabling infra

↳ cold storage
↳ warehousing
↳ food processing units

- Regional disparity (64% in U.P, Punjab, Haryana, Chhattisgarh)

- Expensive means of transport:

↳ speed of road haul 25-30 kmph
↳ railways - 42 kmph

Solution

~~farm~~ ~~back to~~ ~~farm~~ approach

↳ ↑ agri. logistics - storage - transport
P ↳ agro processing
M ↳ agro marketing

Jashodh Dalwari

- Use of AI in tracking goods

- Agri warehousing - part of Priority Sector Lending

- Kisan Suvidha App - info access

Shankar Kumar committee

↳ Private entrepreneurship guarantee scheme

↳ cold storage storage capacity augmentation by 30-40L tonnes

↳ Transport of perishables in Reefer units

↳ New road map to ~~strengthen~~ speed up silo construction

↳ 100L tonnes of storage by 2024.

HORTICULTURE

Data

315 MT (2019-20)

→ 33% to agri GVA

→ Food grain for a decade

↓ inputs (fertilisers)

Climate Resilience > grain crops

15,000 kg / hectare

Price realisation better

→ lesser area

→ Rising demand

~3000 wheat

25 m ha hort
127 m ha grain

health aware
income p
export needs
population

P M SAMPAADA

Scheme

Mission for Integrated Development of Horticulture

- 60:40 / 90:10

- Centrally sponsored

- Holistic growth of Horti sector

- Focus

✓ Quality seeds

✓ Quality planting material

✓ Production enhancement - infrastructure

✓ Stakeholder approach Post harvest losses Improved marketing

fruits
vegetables
roots & tubers
mushrooms
spices

coconut / flowers
cashew, cocoa, bamboo

Challenges

- Wastage

- Infra - cold storage / warehouses

- Road

- Policy support

- Productivity → China: 30,000 kg

- Transport infrastructure 2% through rail only

Best Practices

✓ Niche identification

eg: Mushroom farming

✓ Strawberry cultivation

at Meghalaya

MINIMUM SUPPORT PRICE

Sanjay Agarwal committee

- Centre constituted a committee to examine how to make the MSP for crops more effective
- 1) crop diversification
 - 2) 2BNF

MSP

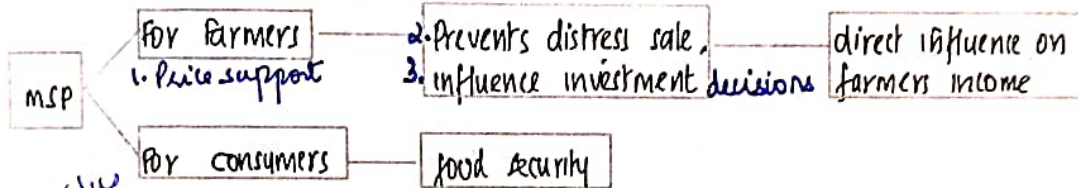
It is a 'minimum price' for any crop that considers as remunerative for farmers and hence deserving of support

OBJECTIVES

- 1960s - wheat → distress sale
1. Protection from price drop for farmers
 2. food security
 3. incentivise desirable crop production

SIGNIFICANCE

(23 crops)
MSP + Procurement = excess prodⁿ of wheat & rice.



Think stateholder

ISSUES F.E.G.

- Govt side (CACP → CREA declares)
- not legally bound to pay MSP
- Subsidy burden: (2.42 Lcr)
 - open ended procurement → food wastage
 - regional disparity in procurement (↑ in Punjab & Haryana; ↓ eastern UP)

Farmers side

- demanding C2 for calculation
- legalisation of MSP

Economy

- market distortion (WTO - market distorting subsidy)
- food inflation (↑ MSP every yr → price of grain w/o value add)

Environmental

- distorted cropping pattern - monocropping practices
- Soil health
 - ↳ water use inefficiency;
 - ↳ soil diversification depletion
 - ↳ unintended consequences

LEGALISATION OF MSP - CHALLENGES

- heavy subsidy burden on Govt (already high)
- assured purchase w/o requisite capacity to store
- mandatory coverage of all crops
- Surplus production (not based on market)

SUGGESTIONS

1. MS Swaminathan Committee - MSP @ 50% profit above the cost of production (above C2)
2. Shantakumar Committee - revisit MSP policy

WAY FORWARD

- decentralised procurement - Shantakumar
- Price stabilization schemes
- Price Deficiency Payment - PM AASHA (MSP-selling rice)
- Incentivise crop diversification
- Promote tech and investment in Agriculture
- Ramesh Chand recommended adoption of Deficiency Price Payment by state & state agencies (not FCI)

(Use for Fisheries)

ANIMAL HUSBANDRY

→ Focus on animal husbandry, food processing and agriculture modernization to become self-sufficient & global leader in agriculture - PM (NITI Aayog &c)

DATA

→ Livestock census 2019 - Total livestock population showed an increase of 4.6% over previous census
→ It shows a decline in indigenous cattle population

→ India is world's largest milk producer

→ Live stock sector contributes 4% of GDP; 25% of agricultural GDP

→ 70% rural women employed
→ 16% monthly income

1) Rashtriya Gokul Mission
→ Conservation of indigenous breeds

2) National Livestock Mission - to ensure qualitative & quantitative increase in livestock production & capacity building of stakeholders

3) National Animal Disease Control **NADCP** Programme - for FMD & Brucellosis

4) Animal Husbandry Infrastructure Development Fund (AHIDF) - to support private investment in diary processing, value addition & cattle feed infrastructure

5) e-Gopala - comprehensive breed improvement market place and information portal + Pashu Aadhar

ONE HEALTH INDIA



Human — Domestic animals — wildlife

SIGNIFICANCE 3E + 3N

1) Economic security
→ income for farmers — 16% of farmer's income
→ agricultural use (e.g.) bullocks; manure

2) Economy - ancillary services → economy growth (4% GDP) → more industry
→ major producer of milk, egg, meat
→ leather industry

→ Emp't for rural women - gender parity (70% rural women)

3) Environment

→ manure - animal waste: natural fertilizer (e.g. Manda buffalo)
→ indigenous variety conservation - climate resilience

4) Social security

→ insurance against disasters
→ meet financial emergency (26% monthly income)

5) Nutritional security

→ proteins from milk, egg, meat

CHALLENGES (convert to measures needed)

→ unorganised sector

→ gaps in forward - backward linkages: rural connect market access

→ lower quality of live stocks

→ 80% bovines are low on productivity reared by small & marginal farmers

→ infrastructure deficiencies

→ chilling infrastructure for dairies - (AHIDF)

→ low awareness about indigenous breeds: Lumpy skin disease

→ spread of animal diseases: Anthrax, Skin Disease

→ Shortage of veterinarians: chicken, Lumpy skin

→ Contribution to global warming: on of methane emissions (largest source) 30%

WAY FORWARD

→ R&D, livestock extension services

→ Quality of breeds & fodder → Infra dev for value addition

→ Effective marketing

→ Indigenous breed promotion

BEST PRACTICES

→ Amul model

→ Sukhet Model

→ Dpt of animal husbandry launched 'One health' pilot project in Uttarakhand
→ To achieve 'one health' through technology and finance
→ The bridge between human and wildlife health are domesticated animals, which are the carriers of a lot of disease

→ Priority area in budget 22-23

NATURAL FARMING

- Natural farming conclave organised at Surat, Gujarat
- Govt set up a committee to promote ZBNF

the basis of progress and speed of the country is the spirit of 'Sabka Prayas'

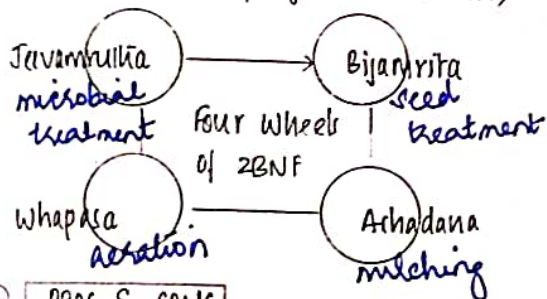
PM Modi

NATURAL FARMING

- Farming practice that believes in the natural growth of crops without adding any fertilizer and pesticides or any other foreign elements

ZERO BUDGET NATURAL FARMING

- promoted through Bharatiya Prakritik Krishi Paddhati programme (BPKP)



PROS & CONS

PROS

more disposable → investment
↑ income ↓ productivity

- locally available inputs
 - ↳ reduce the input cost - virtuous cycle
- sustainable agricultural practice
 - ↳ restore ecosystem health
 - ↳ reduce water consumption (1 kg rice 2500 L water)
- climate resilient crops
- circular economy: zero input cost; reuse ✓
- Food security
- crop diversification.

CONS

- Need scientific validation through multi-location studies - NITI Aayog experts
- noted that yields start dropping after few years
- ZBNF is not really 'zero input' (25% small & marginal - affordability)

CASE STUDY

→ Sri Lankan eco crisis → banning of chemical fertilizers

OTHER METHODS

- Organic farming
- Precision farming
- Integrated farming
- agro forestry

→ Surat Model: local bodies selected 75 farmers from every panchayat & hand-held them with training & other resources. This led to 740,000 farmers in 550 panchayats involved in NF.

CHALLENGES

- 1) monsoon dependence 52% rainfed
- 2) climate resilience issues Heatwaves
 - ↳ extreme weather events
 - eg heat wave - fall in wheat production
- 3) fertilizers - over use "Pesticide treadmill"
 - skewed use
- 4) water stress eg water guzzling crops (rice, wheat)
- 5) mono cropping
 - 1 kg rice : 2500 L water