DDGS POTENTIAL IN ANIMAL FEED

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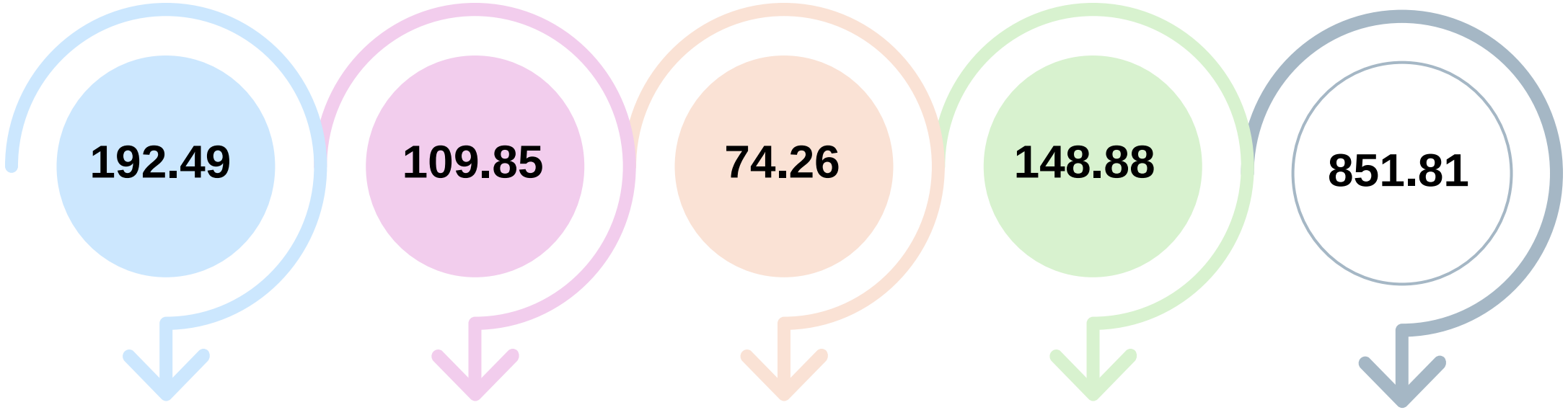
Livestock Population

(Millions)



230.88 Milk Production (MMT)

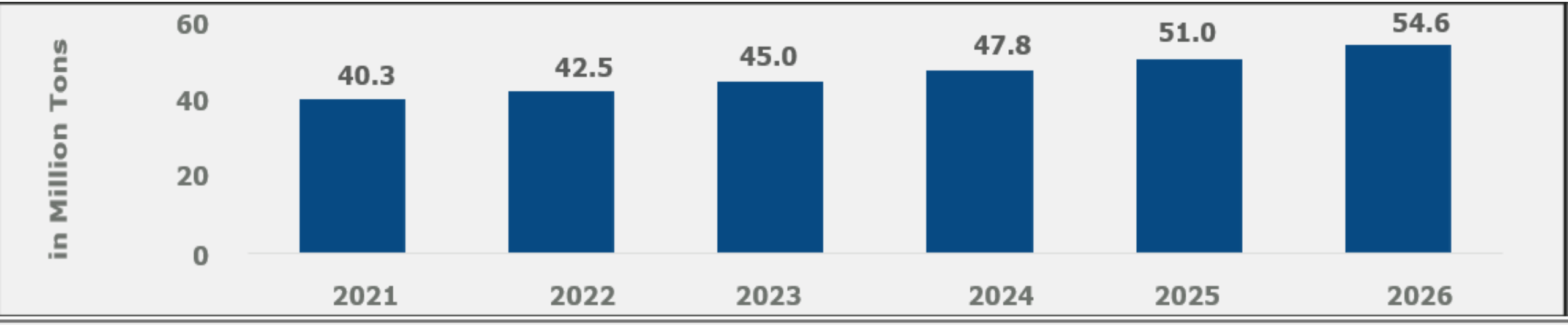
459 gm Per capita availability of milk

101 Per capita availability of eggs

Feed and Fodder Status

	Demand (million tonnes)	Availability (million tonnes)	Surplus/deficit (%)
India			
Green Fodder	827.18	734.20	(-) 11.24%
Dry Fodder	426.10	326.39	(-) 23.40%
Concentrate	85.77	61.0	(-) 28.90%

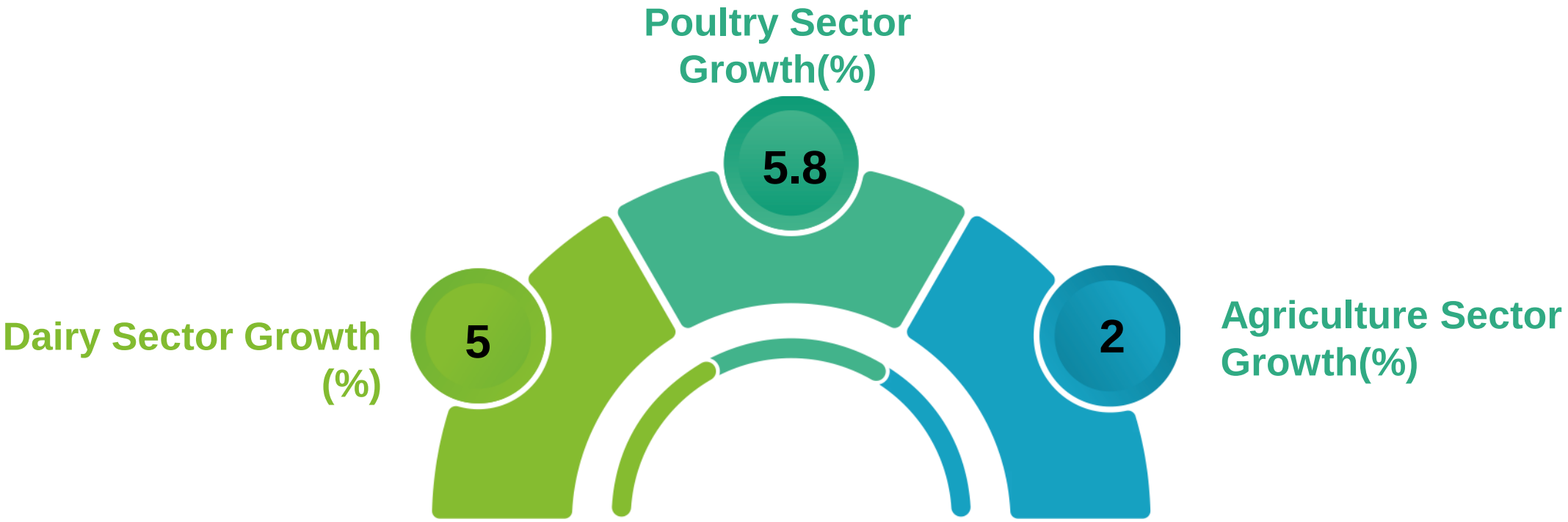
India: Animal Feed Market Forecast: Production Volume (in million Tons) 2021-2026



Source: IMARC

- **Cattle Feeds - 12-13 mmt**
- **Total Animal Feed Production - 45 mmt**
- **Dairy is Growing @ 5.8 % per annum**
- **Poultry is growing @ 6.77 per annum**

Future raw materials availability? Crisis?



- Growth in animal feeds, need more feed raw materials
- There is need to use alternative raw material sources which are economical & easily available.

Possible Alternatives

Livestock Feed

Biofuel (Ethanol)

Co-Products

Ethanol Production and Blending Trends- Year-Wise

Supply Year	Quantity Supplied (In Crore Liters)	Blending %
2013-14	38.0	1.53
2014-15	67.4	2.33
2015-16	111.4	3.51
2016-17	66.5	2.07
2017-18	150.5	4.22
2018-19	188.6	5.00
2019-20	173.0	5.00
2020-21	332	8.50
2021-22	437	10.00
2022-23	542	12.00
2023-24	698	15.00
2024-25	988	18.00
2025-26	1013	20.00

Waste grain and partially damaged (FCI)

Starch content and ethanol yield of various feedstocks

Feedstock	Starch (%)	Ethanol Yield (L/MT)
Sugarcane	-	654
Barley	67.1	399
Broken rice	80.1	500
Corn	71.8	408
Oats	44.7	262
Wheat	63.8	375

Quantity of Products

1 Kg Corn = 0.40 lit ETOH + 0.32 Kg DDGS

Strategies

Quantitative and qualitative enhancement of feed resources

Distilleries Dried Grains Solubles (DDGS)

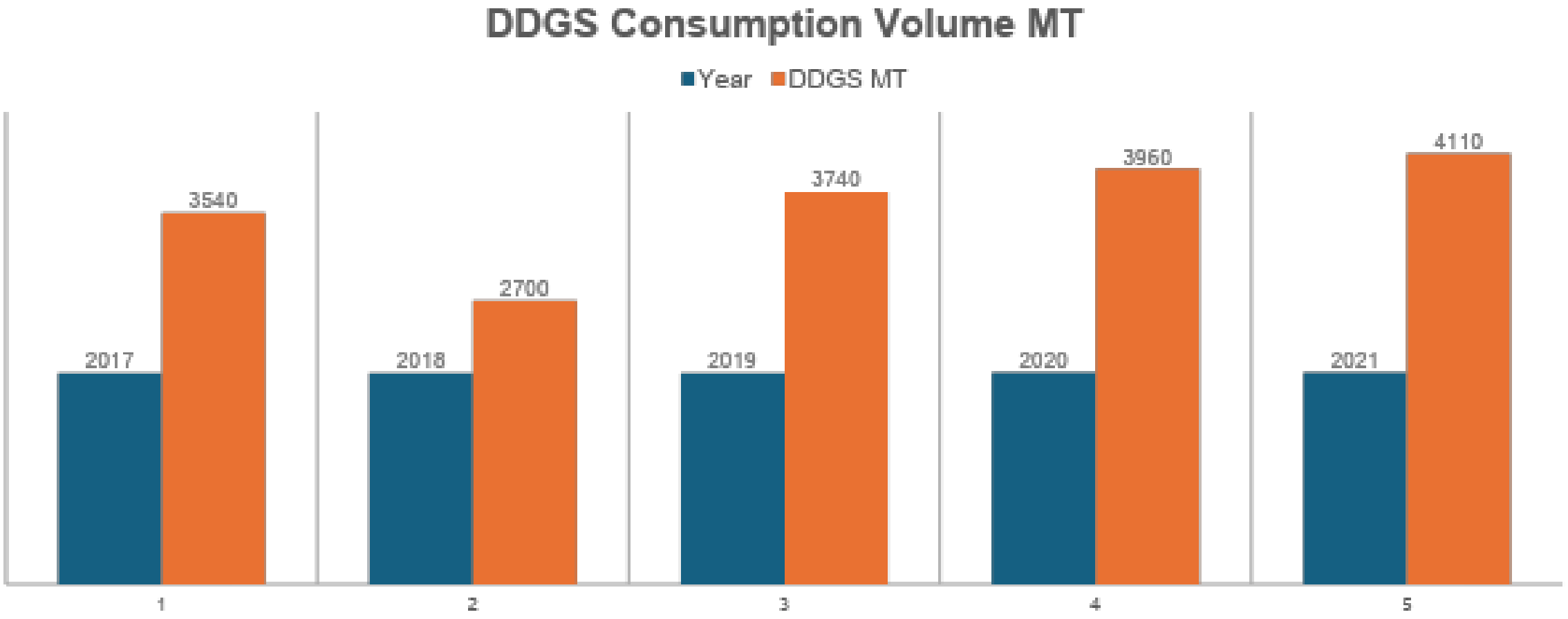
India second largest rice producer after China

(130.29 Million ton)

Distillers grain as a feed ingredient

- Relatively high protein content
- High-energy content
- High concentration of bypass protein (55 percent of crude protein)
- Low-starch content reduces the potential of high-energy rations
- Contains dried yeast cells that provide vitamins, improve palatability, increase fiber digestion and microbial protein synthesis
- Highly digestible neutral detergent fiber (NDF) that increases energy content and stimulates rumen microorganisms

DDGS Consumption (MT)



Future availability of DDGS

	22-23	23-24	24-25	25-26
Grain ethanol (cr lt)	12400	30000	40000	50000
DDGS (MMT)	0.47	1.34	1.89	2.54
Feed Sector (MMT)	43.00	45.00	47.00	49.00
Penetration (%)	1.10	2.98	4.03	5.00

Comparison of common bio-fuel co-products

(Natrajan et al., 2022)

Parameters	R -DDGS		C-DDGS	
	Mean%	Range	Mean%	Range
Crude protein (%)	45.88	38.46-53.61	28.50	24.01-34.93
Crude fiber (%)	3.38	1.14-6.74	9.15	6.88-11.41
Ether extract(%)	4.36	1.47-5.69	7.36	2.75-10.98
Total ash(%)	4.60	1.11-9.24	3.84	3.25-4.43
Calcium(%)	0.25	0.10-0.70	-	-
Phosphorus(%)	0.68	0.46-1.34	-	-

Comparative proximate composition of soy DOC with rice DDGS

Patil et al 2008, Butle and Dhok, 2024

Attributes (%)	Soy DOC	Rice DDGS
Dry matter	91.17	90.51
Moisture	8.83	9.49
Crude protein	45.77	50.06
Crude fat	1.40	4.95
Crude fibre	6.70	3.65
NFE	39.23	45.04
Total ash	6.90	4.89
Acid insoluble ash	2.43	1.20

Amino acid profile- corn Vs DDGS

Amino acids	Corn	DDGS
Arginine	0.54	1.05
Valine	0.51	1.63
Histidine	0.25	0.70
Isoleucine	0.39	1.52
Leucine	1.12	2.43
Lysine	0.24	0.77
Methionine	0.21	0.54
Phenylalanine	0.49	1.64
Threonine	0.39	1.01
Thryptophan	0.09	0.19
Tyrosine	0.43	0.76

Maximum inclusion level

Kalscheur et al., 2012

Production stage	DDGS %
Pre-weaned calves	**25**
Growing heifers	**30**
Dry cows	**15**
Lactating cows	**20**

Milk Production and methane emission in cows on Corn DDGS

Benchaar et al., 2013

% Inclusion in feed	0	10	20	30
Milk, lt./day	32.6	35.1	35.8	36.6
4% FCM	32.1	34.5	34.1	33.7
CH_4 gm/day	495	490	477	475

2. Use of DDGS of rice origin with **47 % CP, 2% Oil and CF of 3%**

Level	0	5%	7.5%	10%
Egg %	86%	90%	92%	92.6%
Weigh Gain	132 g	194 g	225 g	253 g
Egg Mass	3046	3219	3305	3311

Higher methionine, (0.40% vs 0.44%), water soluble vitamins, biologically active substances and prebiotic contents were claimed to be reasons for improvement

Enzyme (-)	Enzyme (+)
88.3%	92.0%
206 g	203 g
3157	3283

Ref: CARI, ICAR, 2020

Research at MAFSU

- **Sorghum (Jowar) was used at a constant 10% level with and without Acidifier, Enzymes and both.**
- **The trial lasted for five weeks.**
- **Conclusion : plain sDDGS can be used at 10%.**
- **However, combining Enzymes and an Acidifier was the best.**

Patil and Rande, 2008

Research at MAFSU

- **Compared Corn DDGS, Sorghum DDGS and Rice DDGS with or without enzymes.**
- **Conclusions : All DDGs up to 10 % were OK without enzymes and at 15%, they were OK with enzymes.**
- **In the order of performance, Corn was better followed by Rice and then was Jowar.**
- **Wide variation in the quality of DDGS with respect to Protein content and other nutrients was observed**

Khose and Manwar, 2014

Research at MAFSU

- **Rice DDGS : CP of the DDGS was 47% and ME was 3500 Kcal/Kg.**
- **Inclusion of rDDGS at 0,5,10 and 15% of the diet replacing Maize and some oil. The diets were iso-nitrogenous and iso-caloric.**
- **The trial lasted for six weeks.**
- **All groups with DDGS performed poorly concerning all the parameters studied.**
- **As the level of DDGS increased, there was a deterioration in the performance**

Dongre and Desai, 2015

Rice DDGS we used at MAFSU

Nutrients (%)	Rice DDGS
Dry Matter	90.96
Crude Protein	50.72
Ether Extract	4.95
Crude Fibre	3.64
Nitrogen Free Extract	37.28
Total Ash	3.41
Calcium	0.81
Phosphorus	0.95
Methionine	1.19
Lysine	0.64
ME (Kcal/kg)	3400

Research at MAFSU : layer

- **Compared Rice DDGS inclusion at 5, 10, 15 % replacing soya meal in layer ration (59-70 wks).**

- **Conclusions: All DDGs at all levels did not influence egg production, mortality, FCR. HHEP (77.06 , 77.78, 76.44 and 76.31) in 84 days.**

- **The cost of production of eggs was less in the 15 % inclusion group. (Rs 0.18/ egg)**

Khose and Adkine, 2023

Research at MAFSU : broiler

(Werulakar and Dhok., 2023)

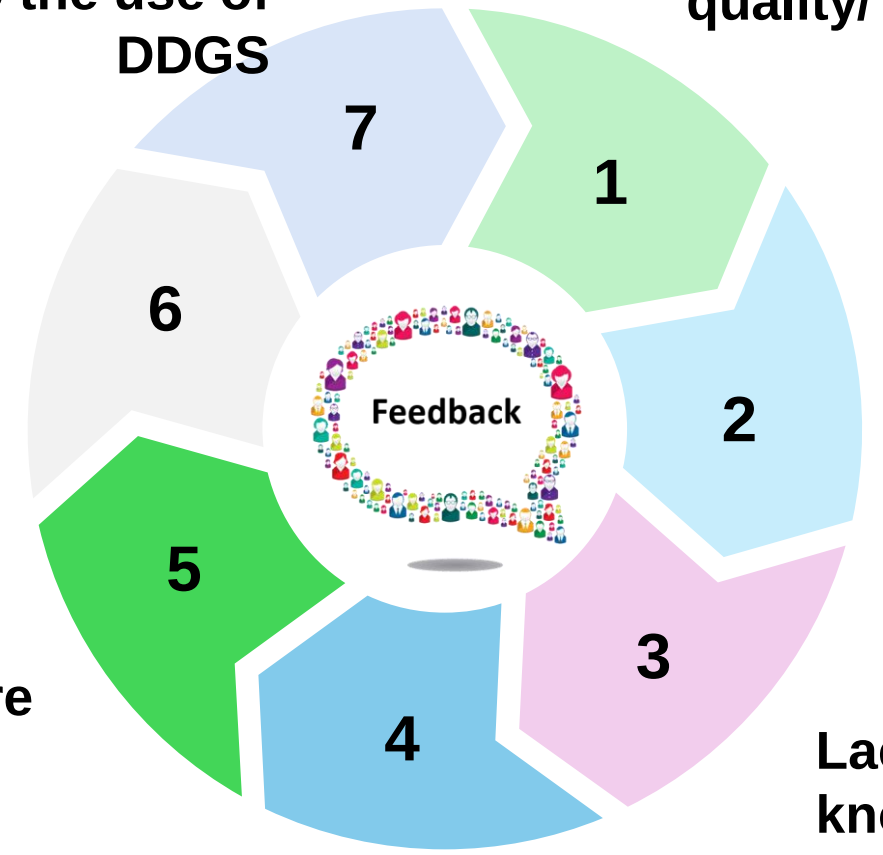
Parameters	Control	15 rDDGS	15 rDDGSE	20 rDDGS	20 rDDGSE
Initial BW, g	43.23	43.15	43.72	44.45	43.33
Final BW**, g	3158.5^{c}	2973.0^{bc}	2990.8^{bc}	2778.4^{a}	2832.1^{ab}
Feed consumption**, g	4717.7^{c}	4595.1^{bc}	4532.4^{bc}	4321.9^{a}	4517.9^{b}
FCR**	1.49^{a}	1.54^{b}	1.51^{ab}	1.55^{bc}	1.59^{c}
Nutrient digestibility %					
DM	73.19	71.55	72.75	70.74	71.50
EE	73.41	71.54	72.56	72.40	71.40
CP**	68.29^{b}	58.46^{a}	64.20^{b}	56.32^{a}	65.12^{b}
Gut health – No significant changes due to rice DDGS					
Economics					
Net Profit (Rs/kg)	4.46	6.72	7.62	7.24	5.92

Research at MAFSU : broiler phas wise

(Butle and Dhok., 2024)

Parameters	Control	20 rDDGS All Phases	20 rDDGSE All Phases	20 rDDGS Starter-Finisher	20 rDDGSE Starter-Finisher	20 rDDGS Finisher	20 rDDGSE Finisher
Initial BW	46.33	45.66	46.33	46.33	46.66	47.33	47.33
Final BW**	2422^{b}	2326.6^{a}	2420^{b}	2440^{bc}	2442^{bc}	2427^{b}	2475.3^{c}
Feed cons.**	3721^{c}	3579^{a}	3645^{b}	3721.4^{c}	3685.6^{b}	3730.8^{c}	3756.2^{c}
FCR**	1.56^{a}	1.57^{a}	1.53^{a}	1.55^{a}	1.54^{a}	1.56^{a}	1.54^{a}
Nutrient digestibility %							
DM	73.13	70.86	70.53	71.02	72.81	71.77	72.18
EE	73.52	72.47	73.74	79.91	72.54	71.80	71.33
CP**	67.08^{c}	65.45^{bc}	65.12^{b}	63.02^{a}	65.52^{bc}	64.29^{ab}	70.14^{d}
Gut health – No significant changes due to rice DDGS in different phases							
Economics							
Net Profit	11.03	19.24	17.84	20.01	20.30	17.52	18.25

Feedback from Stakeholders & challeng

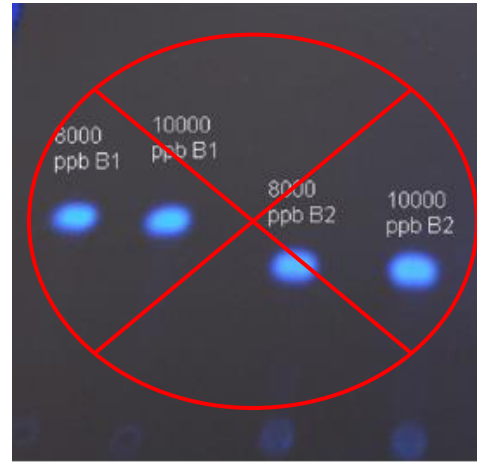


1. Variation in product quality/ Consistency
2. Mycotoxin content is the main constraint.
3. Lack of knowledge among Users
4. Product Improvement
5. Moisture
6. No Standards (Adulteration)
7. All Tests needed to be done prior to the use of DDGS

Next targets

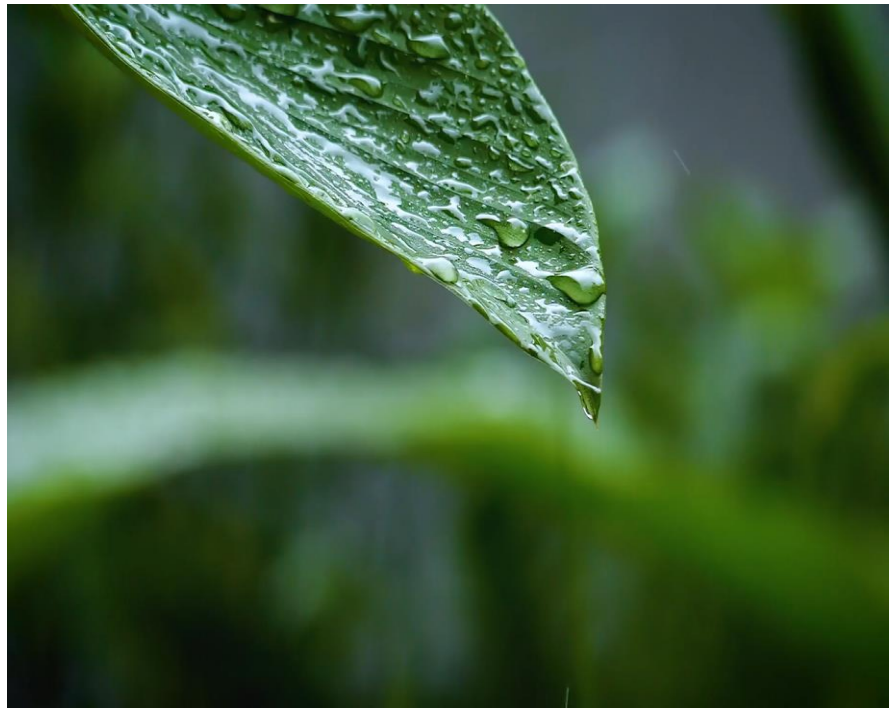
- Zero soya diets for layers

- Mitigation of mycotoxins in DDGS
- Use for small ruminants feeding



- Outreach for efficient utilization of DDGS

Take home message



- **Biofuel Co-Products are cheaper, lowering the cost of feed for animals and also reducing potential threats to the environment.**
- **Need to build acceptability of DDGS in the Animal Feed sector in a staged manner**
- **With Support from CLFMA of India & Ministry of Animal Husbandry, IDA, the Poultry Breeders Association needs to work with its members to build Consistency in Product Quality, control mycotoxins and moisture.**
- **BIS to Get Standards in Place for ingredients /packing etc.**
- **Need to conduct an Outreach program with nutritionists and feed millers on the benefits of DDGS**

Take home

- Use of DDGS in livestock feed offers opportunities
- There is nutritional variability requires careful QC and formulation
- Poultry benefits from enzyme addition and optimize AA composition
- Future supply is assured
- DDGS is valuable feed ingredient for livestock feed
- CLAFMA, DAHD, Breeders association coordinated efforts required to built consistency for efficient use DDGS.


Thank you!