



CMS and CMS+



SUMMARY

- **What is CMS?**
- **What is its production procedure?**
- **Composition**
- **Indications**
- **Difference between Molasses, CMS and CMS Plus**
- **Inclusion Rate**
- **What to expect by Using CMS and CMS Plus**
- **Field Trials**

What is CMS?

- CMS or Condensed Molasses Solubles, known as **vinasse** in the rest of Europe, is the name given to the **evaporated effluents from fermentation industries based upon molasses** (Hansa Melasse Handelsgesellschaft mbH, 2014)
- **Condensed molasses solubles (CMS)** is obtained by condensing to a syrupy consistency the residue from the yeast **fermentation of molasses** after the removal of the alcohol by distillation (Canadian Feeds Regulations, 1983)

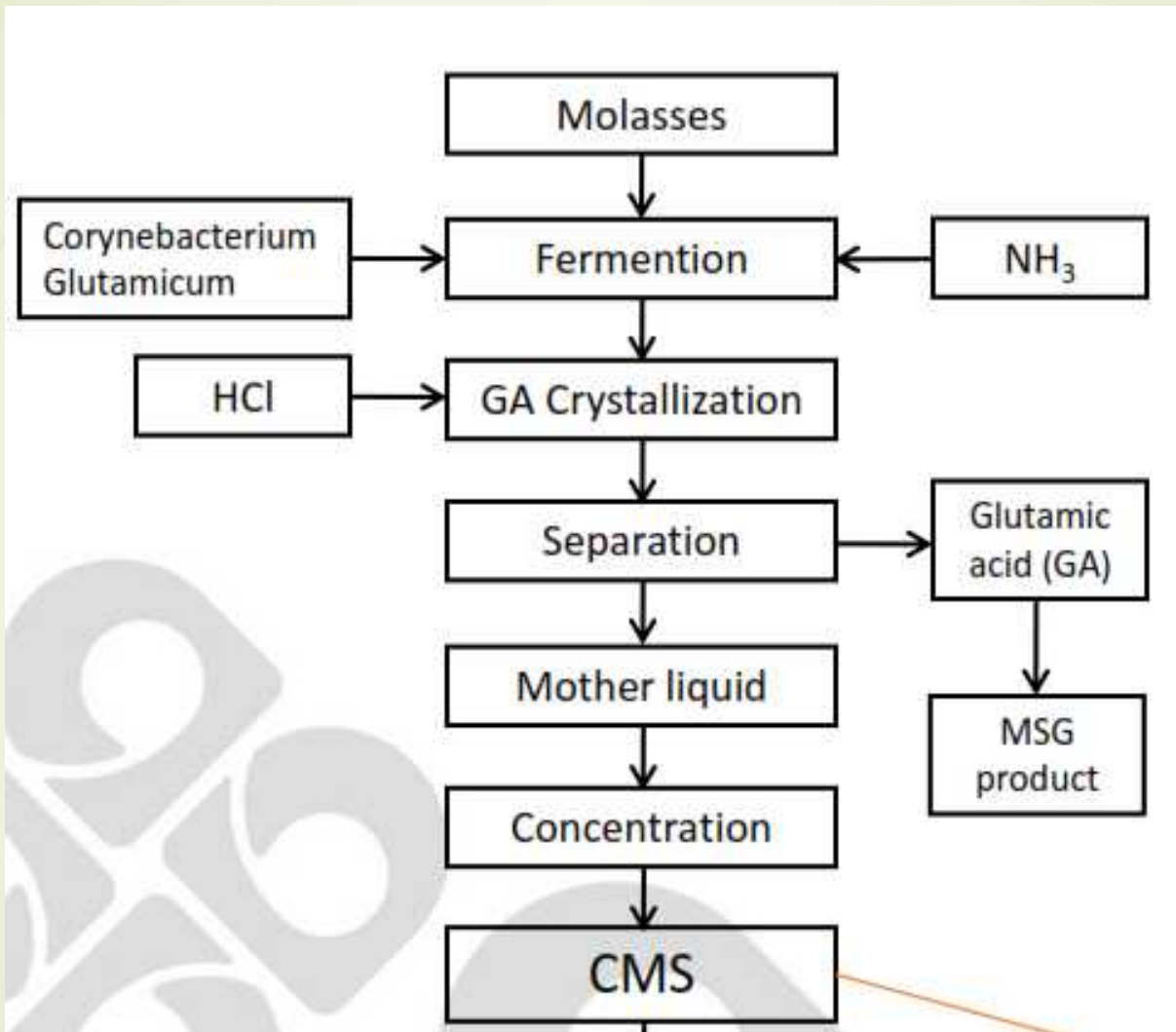




What is fermentation?

- **the chemical breakdown of a substance by bacteria, yeasts, or other microorganisms, typically involving effervescence and the giving off of heat.**
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Production Process of CMS





CMS+

- **Having CMS and Molasses**
 - **Best to replace Soya Bean Meal and Molasses**
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Specification

Item	Method	Unit	Liquid
Appearance	PD100069	-	Dark brown
Moisture	AOAC 2012 (967.03)	%	-
Moisture	The analysis of molasses (UM-1992)	%	Max 44
Crude protein	AOAC 2012(984.13)	%	Min 30
Arsenic content	JSFA VIII	ppm	Max 2
Lead content	Ref.AOAC 2012 (985.01)	ppm	Max 5
pH	PD100005	-	4.5-5.5
Hormone		-	Negative

Typical Analysis

Item	Method	Unit	Liquid
Metabolizable Energy (ruminant)	INRA method	Kcal/kg	2,275
Metabolizable Energy (swine)	Internal method	Kcal/kg	2,315
Metabolizable Energy (poultry)	TCVN 8762:2012	Kcal/kg	1,301
Crude protein	AOAC 2001.11	%	32.60
Pepsin digestibility	AOAC 971.09 (VF)	%/CP	96.35
Carbohydrates / NFE	Calculation	%	14.7
Total sugar	Luff schoorl method	%	1.83
Lipid	ISO 6492:1999	%	0.43
Fiber	AOCS Ba-6a-05	%	< 0.5
Humic acid	TCVN 8561: 2010	%	3.76
Fulvic acid	TCVN 8561: 2010	%	27.18
Ash	EC 152/2009	%	12.13
Moisture	AOAC 977.10	%	40.67
pH	pH meter		4.88

Minerals Details

Item	Method	Unit	Liquid
Cl ⁻	Potentionmetry	%	10.19
Potassium	GE297-ICP MS (VF)	%	2.29
Sodium	GE297-ICP MS (VF)	%	1.09
Sulphur	AOAC 980.02 (2012)	%	0.34
Magnesium	GE297-ICP MS (VF)	%	0.50
NaCl	AOAC 969.10 (VF)	%	2.77
Iron	GE297-ICP MS (VF)	ppm	173
Manganese	GE297-ICP MS (VF)	ppm	60.18
Copper	GE297-ICP MS (VF)	ppm	0.84
Zinc	GE297-ICP MS (VF)	ppm	11.56

Amino Acid Analysis

	Liquid
Asp	0.95
Thr	0.16
Ser	0.13
Glu	4.9
Pro	0.19
Gly	0.19
Ala	0.86
Val	0.23
Met	-
Ile	0.20
Leu	0.33
Tyr	0.10
Phe	0.03
His	0.04
Lys	0.13
Arg	0.14
Trp	0.03



Vitamins

Niacin (**)	mg/kg	201.6
Vitamin B2 (**)	mg/kg	125.0

Mycotoxin and Heavy Metals Analysis

Item	Method	Unit	Liquid
Alfatoxin B1	CH038-HPLC	ppb	Not detected
Alfatoxin B2	CH038-HPLC	ppb	Not detected
Alfatoxin G1	CH038-HPLC	ppb	Not detected
Alfatoxin G2	CH038-HPLC	ppb	Not detected
Heavy metals	GE297-ICP MS (VF)	-	Done
Ecoli	ISO 16649-2:2001	cfu/g	<10
Coliform	ISO 4832:2006	cfu/g	<10
Salmonella	ISO 6579-1:2017	/25g	Negative



Advantages

- **Reducing feed production cost**
- **Extra micro nutrients**
 - Microbial protein, **humic substances**, amino acids, minerals and small peptides
- **Improving feed quality**
 - Reduce dusting and enhance pelleting quality
 - Improve palatability
 - Stabilize CP test result and appearance



Extra benefits for ruminants

- Non-protein nitrogen, microbial protein can be **utilized rapidly by ruminal microbial flora**
- **Inexpensive/stable protein** supplements insufficient supply from Gramineae/Poaceae grass in Southeast Asia*
- Cl⁻ and Ca content helps to **prevent milk fever** in dry period (GR Oetzel., 2015)
- High humus content **reduces somatic cell counts** in the milk and occurrence of mastitis (DT Lin., 2001)
- Compare to Urea, CMS has **extra micro-nutrients** (Ca, Na, Mg, S, Vitamin B, Amino Acids, peptides)




Potential Customers

- **Basemix /concentrate feed factories** (as partial filler to stabilize CP content)
- **Fish/shrimp feeds** (consistent appearance/attractant)
- **Duck feeds** (to solidify pellet)
- **Ruminant feeds** (to supply stable protein and prevent milk fever)

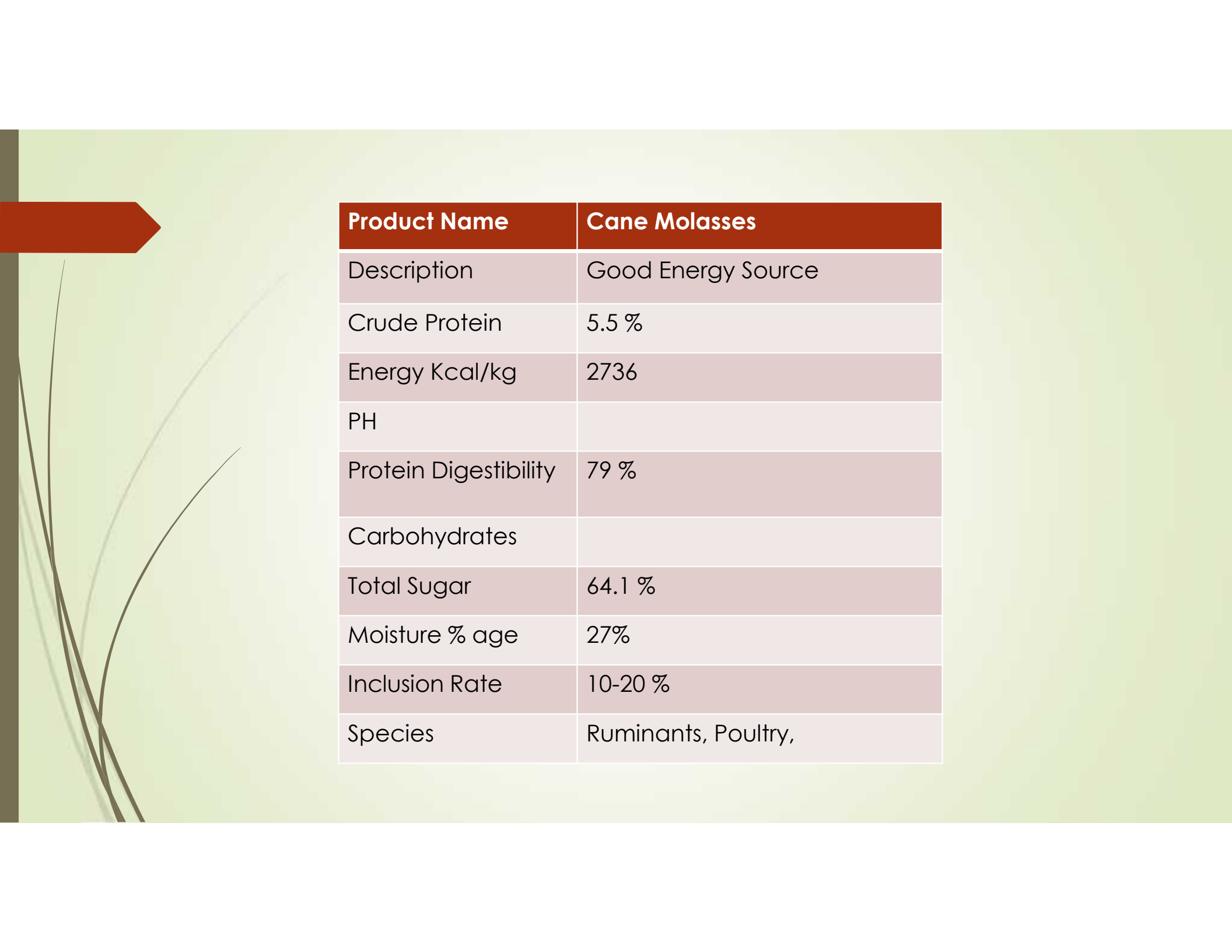


CMS+

- **Having CMS and Molasses**
 - **Best to replace Soya Bean Meal and Molasses**
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Product Name	CMS	CMS+ 91
Description	Condensed Molasses Soluble	Condensed Molasses Soluble Plus
Crude Protein	32.6 %	33.7 %
Energy Kcal/kg	2275	2492
PH	4.5-5.5	5.02
Protein Digestibility	96.35	98.2 %
Carbohydrates	14.7 %	12.6 %
Total Sugar	1.83 %	8.10 %
Moisture % age	44 %	41.9 %
Inclusion Rate	2-4 %	3-4 %
Species	Ruminant,Aqua,Poultry	Ruminant,Aqua,Poultry



Product Name	Cane Molasses
Description	Good Energy Source
Crude Protein	5.5 %
Energy Kcal/kg	2736
PH	
Protein Digestibility	79 %
Carbohydrates	
Total Sugar	64.1 %
Moisture % age	27%
Inclusion Rate	10-20 %
Species	Ruminants, Poultry,



	% of total amino acids
Alanine	3.4
Arginine	3.1
Aspartic Acid	7.4
Cystine	0.5
Glutamic Acid	21.6
Glycine	1.9
Histidine*	2.6
Isoleucine*	4.8
Leucine*	9.2
Lysine*	7.1
Methionine*	2.4
Phenylalanine*	4.8
Proline	9.4
Serine	5.5
Threonine*	4.2
Tryptophan*	0.8

CMS Vs CMS Plus and Molasses

	Molasses	CMS	CMS +
Pros	<ol style="list-style-type: none">1. Good flavor2. Reduce dusting3. Energy supplement	<ol style="list-style-type: none">1. Good flavor2. Reduce dusting3. Extra Protein supplement4. Improve feed quality and production stability	<ol style="list-style-type: none">1. Good flavor and fluidity2. High C/P value3. Improve feed energy and protein4. Improve feed quality and production stability5. Improve nitrogen balance for ruminants
Cons	<ol style="list-style-type: none">1. Unstable quality2. Easy to go bad3. High viscosity4. Low pH5. Price variation	Non-protein nitrogen	

Species	Stage	Scale	Type	Dosage	Results	References
Broiler	0 – 8 wks	600	CMS+82	< 5 %	Partially replace SBM, Molasses, Salt. Same growth performance (feed intake, weight gain, FCR), blood profile, metabolism, carcass quality	National Chiayi University, Taiwan., 2002
Broiler	3 – 8 wks	128	CMS+82	1, 3, 5 %	Increased feed intake, weight gain, improved FCR	National Pingtung University of Science and Technology, Taiwan., 2001
Meat Duck		15,000	CMS+82	1, 2 %	Increased feed intake, weight gain, improved FCR	National Pingtung University of Science and Technology, Taiwan., 1998
Dairy Cattle	Milking	45	CMS	0.75, 1.5 %	Partially replace SBM Increased DMI, Milk production, Protein digestibility; decreased S. C. C.	China Agricultural University, China., 2015
Dairy Cattle	Milking	20	CMS+73	1.5 kg head/d	Partially replace Molasses. Decreased S. C. C., improved milk quality, and increased milk production, DFI	Tunghai University, Taiwan., 2003
Beef Cattle	Finishing	36	CMS (G)	3 %	Partially replace SBM Increased DMI, improved ADG, F/G and meat color	Northwest Agriculture and Forestry University, China., 2017
Dairy Goat	Milking	40	CMS (G)	4 %	Increased milk protein and gross profit.	Northwest Agriculture and Forestry University, China., 2017
Mutton Goat	60 days	48	CMS (G)	2 %	Increased goat meat quality and carcass rate	Northwest Agriculture and Forestry University, China., 2017

*CMS = CMS Liquid; CMS+82 = 80 % CMS + 20 % Molasses

Feed Research Institute Chinese Academy of Agricultural Sciences, China, 2004

Application: Soybean Meal partially replaced with Vedafeed-CMS liquid (2 %, 3 %) in the weaner feed recipe

		Treatment 1 (Control)	Treatment 2	Treatment 3	Treatment 4
		表1 基础日粮组成			
	原料和营养成分	处理1	处理2	处理3	处理4
Corn	玉米, 2级, 8.7	58.50	57.70	57.00	58.00
Wheat Bran	麸皮, 14.4	10.00	9.68	10.15	10.50
Vegetable oil	植物油	2.00	2.10	2.30	1.50
Soybean meal	大豆粕, 44	24.00	23.00	22.00	22.50
Fish meal	鱼粉, 62.8	1.50	1.50	1.50	1.50
Premix	预混料(4%)*	4.00	4.00	4.00	4.00
Lysine	赖氨酸		0.02	0.05	
CMS	CMS		2.00	3.00	2.00
Total	合计	100.00	100.00	100.00	100.00
DE	消化能(Mcal/kg)	3.28	3.25	3.24	3.21
Crude protein	粗蛋白(%)	17.99	18.05	17.95	17.96
Ca	钙(%)	0.92	0.94	0.95	0.94
P	总磷(%)	0.55	0.54	0.53	0.54
Available P	有效磷(%)	0.30	0.30	0.30	0.30
Lysine	赖氨酸(%)	1.18	1.17	1.17	1.15
Methionine	蛋氨酸(%)	0.24	0.24	0.24	0.24
Met + Cys	蛋+胱氨酸(%)	0.54	0.55	0.55	0.55

Adding 2 % Vedafeed-CMS liquid does not change feed quality (Aflatoxin B₁, Total plate count, Molds count, Acid value)

Preserve time		Treatments	Moisture	Aflatoxin B ₁	Total plate count (10 ⁶ /g)	Molds count (10 ⁴ /g)	Acid value
表 4 采样测定结果							
日期	保存时间	测定指标单位	水分 %	黄曲毒素 B ₁ mg/kg	细菌总数 百万个/克	霉菌总数 万个/克	酸价
Day 0	11 月 4 日	处理 1 0	14.6233	<0.01	0.18	1.2	2.0807
		处理 2 2	15.2153	<0.01	0.72	0.8	2.3546
		处理 3 3	15.7338	<0.01	1.17	0.98	2.5991
		处理 4 2	15.6269	<0.01	0.37	1.1	2.343
Day 30	12 月 4 日	处理 1 0	14.2925	<0.01	0.22	1.3	4.8541
		处理 2 2	14.8096	<0.01	0.83	1.0	5.1494
		处理 3 3	15.2448	<0.01	1.35	1.7	5.7109
		处理 4 2	14.9718	<0.01	0.43	1.56	5.1866
Day 45	12 月 19 日	处理 1 0	13.9618	<0.01	0.22	1.3	6.0094
		处理 2 2	14.4039	<0.01	0.89	1.1	6.2276
		处理 3 3	14.7558	<0.01	1.44	1.8	6.9190
		处理 4 2	14.5116	<0.01	0.46	1.6	6.3013
Day 60	元 3 日	处理 1 0	14.1288	<0.01	0.23	1.2	7.2163
		处理 2 2	14.6935	<0.01	0.92	1.2	7.3459
		处理 3 3	15.1441	<0.01	1.49	1.9	8.2624
		处理 4 2	14.7626	<0.01	0.47	1.7	7.5673

- **Stage:** Weaner
- **Scale:** 120 heads, 30 heads/group
- **Application:** Soybean Meal partially replaced with Vedafeed-CMS liquid (2 %, 3 %) in the recipe

表 1 基础日粮组成及营养水平

	原 料	Treatment 1 (Control)	Treatment 2	Treatment 3	Treatment 4
Corn	玉米(2级)8.5(%)	58.50	57.70	57.00	58.00
Wheat Bran	麸皮 14.4(%)	10.00	9.68	10.15	10.50
Vegetable oil	植物油(%)	2.00	2.10	2.30	1.50
Soybean meal	大豆粕 44(%)	24.00	23.00	22.00	22.50
Fish meal	鱼粉 62.8(%)	1.50	1.50	1.50	1.50
Premix	预混料(4%) [*]	4.00	4.00	4.00	4.00
Lysine	赖氨酸(%)	-	0.02	0.05	-
CMS	CMS(%)	-	2.00	3.00	2.00
DE	消化能(MJ/kg)	13.78	13.65	13.61	13.49
Crude protein	粗蛋白 [*] (%)	17.99	18.05	17.95	17.96
Ca	钙 [*] (%)	0.92	0.94	0.95	0.94
P	总磷 [*] (%)	0.55	0.54	0.53	0.54
Available P	有效磷(%)	0.30	0.30	0.30	0.30
Lysine	赖氨酸(%)	1.18	1.17	1.17	1.15
Methionine	蛋氨酸(%)	0.24	0.24	0.24	0.24
Met+ Cys	蛋 + 胱氨酸(%)	0.54	0.55	0.55	0.55



Vedafeed-CMS liquid In Vivo Trial, Dairy Cattle Farm
China Agricultural University, China, 2015

- **Stage:** Milking (2nd – 3rd parity); 30 ± 1.2 kg milk/head/day
- **Scale:** 45 heads, 15 heads/group
- **Application:** Soybean Meal partially replaced with Vedafeed-CMS liquid (0.75 %, 1.5 %) in the TMR

项目 Item	Treatments		
饲料原料 (TMR%) Feeding ingredients	对照组 Control	0.75%组 0.75% CMS	1.5%组 1.5% CMS
苜蓿 Alfalfa hay	6.92	6.92	6.92
青贮 Corn silage	49.99	49.99	49.99
玉米 Corn meal	5.38	5.38	5.38
百事美 Dry lat powder	1	1	1
益康 Yeast culture	0.4	0.4	0.4
百零草 Mgastrin absorbent	0.03	0.03	0.03
食盐 Salt	0.22	0.22	0.22
石粉 Limestone powder	0.67	0.67	0.67
小苏打 Baking soda	0.81	0.81	0.81
碳酸氢钾 KHCO ₃	0.51	0.51	0.51
预混剂 Premix	0.32	0.32	0.32
氧化镁 MgO	0.13	0.13	0.13
燕麦草 Oaten hay	0.27	0.27	0.27
豆粕 Soybean meal	6.9	6.74	6.44
菜籽粕 Rapeseed meal	0.81	0.81	0.81
CMS	0	0.75	1.5

膨化大豆 Extruded soya meal	1.05	1.05	1.05
DEGS	5.38	5.38	5.38
江片玉米 Flaked corn	9.96	9.96	9.96
苹果粕 Apple pomace	1.08	1.08	1.08
甜菜粕 Sugar beet pulp	3.1	3.1	3.1
棉籽 Cottonseed	4.04	4.04	4.04
营养成分 (干物质基础 %) Composition (as DM basis)			
DM%	55.99	56.32	56.52
CP%	17.94	17.97	17.92
NDF%	29.05	28.86	28.7
ADF%	18.75	18.62	18.51
ER%	4.93	4.91	4.89
Ca%	0.76	0.76	0.76
P%	0.38	0.37	0.37
Ash%	9.23	9.25	9.27
NE _L (MJ/kg)	7.53	7.52	7.55
精粗比 (Concentrate/roughage ratio)	62.38	62.38	62.38

CMS对奶牛生产性能的影响
Effects of CMS on milk production



项目 Item	CMS treatments			P值 P-value
	0%	0.75%	1.5%	
DMI(kg/d)	19.67±0.30 ^a	19.68±0.24 ^a	20.55±0.22 ^b	0.022
Milk production(kg/d)	28.92±0.34 ^a	29.10±0.31 ^a	29.85±0.26 ^b	0.045
4% fat corrected milk(kg/d)	29.74±0.35 ^a	30.05±0.32 ^a	31.78±0.28 ^b	P<0.001
Feed conversion rate	1.51	1.53	1.55	-
Milk fat(%)	4.19±0.11	4.22±0.10	4.43±0.09	0.198
Milk protein(%)	3.22±0.04 ^a	3.28±0.04 ^a	3.43±0.04 ^b	0.001
Lactose(%)	4.67±0.05	4.76±0.03	4.70±0.05	0.396
MUN(mg/dL)	10.90±0.38	11.66±0.39	11.93±0.38	0.156
SCC(10 ³ mL)	204.16±25.90 ^a	101.23±10.73 ^b	161.49±29.67 ^{ab}	0.006
Fat/protein ratio	1.30	1.29	1.29	-

CMS对奶牛各营养物质表观消化率的影响
Effects of CMS on apparent digestibility



项目 Item	CMS treatments			P值 P-value
	0%	0.75%	1.5%	
DM消化率(%) Dry matter digestibility	78.14±1.07	78.28±0.66	80.02±0.65	0.231
OM消化率(%) Organic matter digestibility	62.77±2.79	63.92±1.72	66.88±1.70	0.399
CP消化率(%) CP digestibility	67.85±2.14 ^a	68.92±1.67 ^a	73.87±1.44 ^b	0.043
EE消化率(%) EE digestibility	67.82±4.15	70.08±2.39	72.02±1.45	0.597
NDF消化率(%) NDF digestibility	49.05±2.01	50.59±1.82	52.33±3.29	0.668
ADF消化率(%) ADF digestibility	47.33±3.46	42.11±2.08	48.66±2.50	0.243

- **Stage:** Finishing; 12 bulls, 12 cows, 12 bullocks
- **Scale:** 36 heads, 9 heads/group
- **Application:** Soybean Meal partially replaced with Vedafeed-CMS granule (1.5 %, 3 %, 4.5 %) in the concentrate feed

Table 1 Composition and nutrient levels of concentrate of bulls and cows (Dry basis)

项目 Items	谷氨酸渣替代量 Replacement levels of glutamic acid residue			
	对照组(0%)	I 组(1.5%)	II 组(3%)	III 组(4.5%)
	CK	Group I	Group II	Group III
原料组成 Ingredients/ (%)				
玉米 Corn	54	54	54	54
麸皮 Wheat bran	10	10	10	10
豆粕 Soybean meal	25	22.82	20.63	18.44
棉粕 Cottonseed meal	3	3	3	3
菜粕 Rapeseed meal	3	3	3	3
食盐 Salt	0.4	0.4	0.4	0.4
小苏打 NaHCO ₃	0.6	0.6	0.6	0.6
预混料 Premix	4	4	4	4
谷氨酸渣	0	1.5	3.0	4.5
麦草 Wheat straw	0	0.68	1.37	2.06
合计 Total	100	100	100	100
营养水平 Nutrient levels				
消化能 DE/ (MJ/kg)	11.73	11.64	11.54	11.45
粗蛋白 CP/ (%)	19.16	19.16	19.16	19.16
粗脂肪 EE/ (%)	2.82	2.82	2.81	2.80
粗纤维 CF/ (%)	3.69	3.87	4.05	4.23
钙 Ca/ (%)	0.13	0.15	0.17	0.19
总磷 P/ (%)	0.46	0.44	0.43	0.43

Table 2 Composition and nutrient levels of concentrate of bullocks (Dry basis)

项目 Items	谷氨酸渣替代量 Replacement levels of glutamic acid residue			
	对照组(0%)	I 组(1.5%)	II 组(3%)	III 组(4.5%)
	CK	Group I	Group II	Group III
原料组成 Ingredients/ (%)				
玉米 Corn	50	50	50	50
麸皮 Wheat bran	16	16	16	16
豆粕 Soybean meal	18	15.81	13.62	11.43
棉粕 Cottonseed meal	6	6	6	6
菜粕 Rapeseed meal	5	5	5	5
食盐 Salt	0.4	0.4	0.4	0.4
小苏打 NaHCO ₃	0.6	0.6	0.6	0.6
预混料 Premix	4	4	4	4
谷氨酸渣	0	1.5	3.0	4.5
麦草 Wheat straw	0	0.69	1.38	2.07
合计 Total	100	100	100	100
营养水平 Nutrient levels				
消化能 DE/ (MJ/kg)	11.28	11.19	11.09	11.00
粗蛋白 CP/ (%)	18.68	18.68	18.68	18.68
粗脂肪 EE/ (%)	2.83	2.83	2.82	2.81
粗纤维 CF/ (%)	4.17	4.35	4.53	4.71
钙 Ca/ (%)	0.13	0.16	0.18	0.20
总磷 P/ (%)	0.51	0.50	0.49	0.47

- 3 % Vedafeed-CMS granule supplement in beef cattle concentrate feed increased DMI, improved ADG, F/G

Table 4 Effect of glutamic acid residue on average daily gain and DMI of Qinchuan-bulls at the whole

项目 Items	stage			
	对照组(0%) CK	I 组(1.5%) Group I	II 组(3%) Group II	III组(4.5%) GroupIII
始重 IW/ (kg)	292.83±37.23	294.03±39.12	290.30±35.87	290.27±33.41
末重 FW/ (kg)	366.97±39.18 ^b	376.63±38.85 ^{ab}	384.59±31.64 ^a	373.99±35.21 ^b
日增重 ADG	0.82±0.16 ^b	0.92±0.08 ^{ab}	1.05±0.12 ^a	0.93±0.11 ^{ab}
干物质采食量 DMI	8.26±0.14 ^b	8.58±0.09 ^{ab}	9.07±0.19 ^a	9.13±0.13 ^a
料重比 F/G	10.13±0.71 ^a	9.21±0.29 ^b	8.71±0.37 ^c	9.83±0.52 ^b

Table 6 Effect of glutamic acid residue on average daily gain and DMI of Qinchuan-cows at the whole

项目 Items	stage			
	对照组(0%) CK	I 组(1.5%) Group I	II 组(3%) Group II	III组(4.5%) GroupIII
始重 IW/ (kg)	299.90±32.56	305.07±38.17	301.53±32.45	311.97±31.29
末重 FW/ (kg)	372.93±33.18 ^b	389.92±38.50 ^{ab}	390.11±40.05 ^a	388.79±30.17 ^a
日增重 ADG	0.81±0.13 ^b	0.94±0.07 ^a	0.98±0.04 ^a	0.85±0.11 ^b
干物质采食量 DMI	8.13±0.07 ^b	9.17±0.16 ^a	9.16±0.08 ^a	9.01±0.05 ^a
料重比 F/G	10.04±0.64 ^a	9.79±0.26 ^a	9.07±0.38 ^b	9.92±1.47 ^a

Table 8 Effect of glutamic acid residue on average daily gain and DMI of Qinchuan-bullocks at the whole

项目 Items	stage			
	对照组(0%) CK	I 组(1.5%) Group I	II 组(3%) Group II	III组(4.5%) GroupIII
始重 IW/ (kg)	221.67±34.53	219.38±42.32	218.94±42.72	222.47±35.79
末重 FW/ (kg)	301.28±34.17 ^b	302.51±39.19 ^b	314.59±35.21 ^a	310.37±41.06 ^{ab}
日增重 ADG	0.88±0.13 ^b	0.92±0.17 ^b	1.06±0.04 ^a	0.98±0.06 ^{ab}
干物质采食量 DMI	7.18±0.12 ^b	7.54±0.08 ^{ab}	8.07±0.09 ^a	7.86±0.16 ^a
料重比 F/G	8.09±1.21	7.96±0.85	7.67±0.19	7.85±0.72

Vedafeed-CMS liquid In Vivo Trial, Beef Cattle Farm
Northwest Agriculture and Forestry University, China, 2017

-CMS+ liquid In Vivo Trial, Dairy Cow Farm
Tunghai University, Taiwan, 2003

- **Stage:** Milking; 15 - 25 kg milk/head/day
- **Scale:** 20 heads, 5 heads/group
- **Application:** Molasses supplement partially replaced with (Vedafeed-CMS liquid + Soy oil) mixture, 1.5 kg/head/day

Liquid feed formula

表一實驗組液態飼料之組成

營養成分	實驗組別			
	0 (純 mol)	1 (30%CMS)	2 (50%CMS)	3 (70%CMS)
CMS(%)	—	30	50	70
Mol(%)	100	63	43	23
Soy.oil(%)	—	7	7	7
Surfactant*(%)	—	0.1	0.1	0.1
Flavor**(%)	—	0.1	0.1	0.1

*tween 20

**milk flavor

Liquid feed nutrients

表二·各實驗組(0, 1, 2, 3)液態飼料之營養成分

營養成分	實驗組別			
	0 (純 mol)	1 (30%CMS)	2 (50%CMS)	3 (70%CMS)
乾物質(DM %)	77.45	65.99	57.30	48.61
蛋白質(Ptn %)	5.07	11.89	16.68	21.47
脂肪(fat %)	0.20	7.29	7.48	7.67
產乳淨能(NE/L) ^a	1.72	7.61	12.41	17.21
總可消化養分(TDN %)	64.98	59.21	49.79	41.06
非蛋白氮(NPN %)	0.00	7.20	12.00	16.80
TSI ^b %	48.90	31.98	22.98	13.98

^a NE/L = M cal/kg soy oil=5.84

^b TSI = Total sugar Invert

Milk production and milk quality

表七. 各實驗組(0, 1, 2, 3)間乳產量與各乳性狀之比較*

乳性狀/組別**	實驗組別			
	0	1	2	3
Prod.(kg/d)	18.55 ^a	19.96 ^b	19.63 ^b	22.75^c
Fat(%)	4.20^c	3.71 ^a	4.16 ^{bc}	3.97 ^b
Protein(%)	3.54^d	3.43 ^b	3.49 ^c	3.33 ^a
Lactose(%)	4.65 ^a	4.69 ^{ab}	4.66 ^{ab}	4.73^b
S.N.F.(%)	8.75 ^{ab}	8.69 ^a	8.78^b	8.71 ^{ab}
T. Solid(%)	12.94^c	12.46 ^a	12.94^c	12.69 ^b
S.C.C.(×1000)	425.89 ^b	143.81^a	347.81 ^b	305.78 ^b

*各組值為平均值(Mean)

**組別依 0=對照組(mol), 1=30%CMS LQ, 2=50% CMS LQ, 3=70%CMS LQ

abcd 同列平均值有不同字母者表示有顯著差異(p<0.05)

顯著水準 $\alpha=0.05$

Milk quality x milk production

表八. 各實驗組(0, 1, 2, 3)之乳性狀 x 乳產量之比較*

乳性狀/組別**	實驗組別			
	0	1	2	3
Fat(%)×Prod.	75.94 ^a	73.20 ^a	82.39 ^b	88.29 ^c
Protein(%)×Prod.	65.79 ^a	67.67 ^{ab}	68.95 ^b	74.99 ^c
Lactose(%)×Prod.	86.49 ^a	93.66 ^b	93.09 ^b	107.71 ^c
S.N.F.(%)×Prod.	163.10 ^a	172.97 ^b	174.48 ^b	197.44 ^c
T. Solid(%)×Prod.	238.87 ^a	247.32 ^{ab}	256.82 ^b	285.86 ^c

*各組值為平均值(Mean)

**組別依 0=對照組(mol), 1=30%CMS LQ, 2=50% CMS LQ, 3=70%CMS LQ

abcd 同列平均值有不同字母者表示有顯著差異(p<0.05)

顯著水準 $\alpha=0.05$

Liquid feed (DFI)

表九. 各實驗組(0, 1, 2, 3)液態飼料採食量(DFI)之比較*



	實驗組別**			
	0	1	2	3
DFI(g/20min)	643.22 ^b	694.74 ^c	721.24 ^c	569.99 ^a

*各組值為平均值(Mean)

**組別依 0=對照組(mol), 1=30%CMS LQ, 2=50% CMS LQ, 3=70%CMS LQ

abcd 同列平均值有不同字母者表示有顯著差異(p<0.05)

顯著水準 $\alpha=0.05$



	SBM	RSM	DDGS	CMS (G)	CMS (L)
Crude protein (%)	46	39	26	63	30
Protein digestibility (%)	80	78	77	81	91
Digestible protein (%)	36.8	30.4	20.0	51.0	27.3
Price (USD/MT)	365	362	180	230	45*
Unit protein (USD/MT/%)	9.92	11.91	9.00	4.50	1.65



What to Expect from CMS and CMS+

- **Increase Feed Intake**
- **Increase Palatability**
- **Increase Pellet Quality**
- **Partially Replace Soyabean Meal other protein sources**
- **Partially Replace Molasses**
- **Increase in Milk Production**
- **Increase in Milk Protein and Fat**
- **Increase in Weight Gain**



Pack Size

- **200 Kg Drum**
 - **23 metric tons Flexi tank**
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