APPLE POMACE

Some possible alternative uses for apple pomace waste after juice extraction

Orchard tree row mulch

A series of NACM trials demonstrated many advantages of partially dried pomace as a tree mulch, especially in young orchards. Annual weeds were suppressed adequately so that herbicide spraying was minimised, fruit kept better on the ground during harvesting, and earlier tree growth and cropping was encouraged. An annual application of around 5cms was recommended. [NACM Technical Report No.3 Weed suppressant mulches for cider orchards]

Improving germination conditions for grass seed

A comparison of the germination of grass seed under mulches of pomace and citrus showed that these materials are more beneficial to germination than other products on the market. These promising results demonstrate a potential market for pomace for the establishment of grass swards in difficult environments such as roadside verges.
[NACM Technical Report R 6.3]

Bioiniculants

For the production of *Trichoderma, Pennicillium and Rhizopus* spp of fungus for use in agricultural and environmental applications. For example, in the control of pathogenic organisms, for the degradation of certain pesticides and for the production of fermented foodstuffs, etc.
[Zuoxing Zheng and Shetty, Kalidas,1998. Solid-state production off beneficial Fungi on apple processing wastes using glucosamine as the indicator of growth. *J.Agric. Food Chem. Vol 46, 2*]

Shiitake and oyster mushroom production on apple pomace and sawdust

Several fungal isolate produced better on a mixture of sawdust and apple pomace which has a slightly higher N level than sawdust alone.
Worrall, J.J. and Yang, C.S. 1992. *HortScience 27 [10];* 1131-33

The following 5 potential uses are taken from 'Treatment and Utilization of Apple Processing Wastes'. Processed Apple Products. Ed. Donald Dowling [Cornell].

Animal feeds

As fresh, ensiled or dried pomace, it is a suitable feed for cows and sheep.

Ethanol

Solid state fermentation process can yield between 30 – 40 g ethanol per kg of wet pomace with a heat evolution of 2.8 kJ/kg/hr.
[Hang et al, 1982. A solid state fermentation system for production of ethanol from apple pomace. *J Food Sci 47 1851-52*]

Natural gas

By applying anaerobic digestion to apple pomace, nearly 80% of organic matter can be converted into a substitute natural gas.
[Jewell and Cummings 1984, Apple pomace energy and solids recovery. *J Food Sci 48 407-10*]

Citric acid

Microbial production of citric acid using *Aspergillus niger* mould to convert apple pomace sugars.

[Kapooor et al 1982. Citric acid. In Prescott amd Dunn’s industrial microbiology. Ed G.Reed, 709-49. AVI Pub.Co., Westport CT. Hang and Woodmans 1984, Apple pomace, a potential substrate for citric acid production by *A niger*. *Biotechnol. Lett.*6; 763-64]

Charcoal for water purification

Apple pomace may be dried, heated, ground up and moulded into charcoal briquets for combustion. This charcoal is also extremely efficacious for water purification especially in relatively high concentrations of impurities.

[Walter and Sherman 1976 Fuel value of grape and apple processing wastes. *J.Agric Food Chem. 24; 1244-45.* Jewell and Cummings 1984, Apple pomace energy and solids recovery. *J Food Sci 48 407-10.* Walter and Sherman 1975, Grape and apple pomace charcoal. *J.Agric Food Chem* 23; 1218]

Chemical composition and feed values of pomace and various foodstuffs
Source: ADAS and British Sugar plc

Table 1: Chemical composition and estimated feed value of fresh apple pomace

Nutrient	**Fresh apple pomace**
Dry matter %	15.8 – 20.9
pH	3.2 – 3.7
In the dry matter %	
Crude protein	6.4 – 8.6
Crude fibre	20.5 – 22.1
Ether extract	2.3 – 3.4
Total ash	1.6 – 2.7
Nitrogen free extract	53.2 – 59.2
In Vitro DOMD	65.0 – 69.0
Ruminated ME MJ/kgDM	10.1 – 10.7

DMOD = Digestible organic matter in dry matter

Source: ADAS Feed Evaluation Unit, Drayton

Table 2: Dry matter%, metabolisable energy and digestible crude protein of commonly used ruminant feedstuffs

Feeding stuff	**Dry matter%**	**Metabolisable energy MJ/kgDM**	**Digestible crude protein g/kgDM**
Grass silage; Good	25	10.2	120
Grass silage; Poor	20	7.6	100
Maize silage	21	10.8	70
Brewer’s Grain; Fresh	22	10.0	150
Brewer’s grain; Ensiled	28	10.0	150
Pressed sugar beet pulp	22	12.3	61
Hay; Good	85	10.1	90
Hay; Poor	85	7.5	50
Nutritionally improved straw	90	9.0	8
Dried molassed beet pulp	90	12.5	80
Barley	86	12.9	82
Soya bean meal	90	12.3	453
Dried grassnuts	90	10.6	140
Fresh apple pomace	28	10.2	N/A
Dried apple pomace	93	10.8	8

Source: British Sugar plc

Table 3: Chemical analysis of dried apple pomace

Nutrient	Bulmers pomace	Austrian pomace	French pomace	Mean
Moisture %	6.4	9.8	5.5	7.2

<u>In the Dry matter %</u>

Nutrient	Bulmers pomace	Austrian pomace	French pomace	Mean
Crude protein	5.4	5.2	4.9	5.2
Crude fibre	19.9	18.9	20.5	19.8
Ether extract	2.0	1.6	2.1	1.9
Total ash	1.54	1.41	1.71	1.55
Insoluble ash	1.34	13.1	1.57	1.41
Soluble ash	0.20	0.10	0.14	0.15
Nitrogen free extract	61.2	62.9	60.8	61.6
Total sweetening matter	13.1	21.3	19.3	17.9
Acid detergent fibre	33.5	30.8	33.2	32.5
Neutral detergent fibre	43.7	50.2	44.4	46.1
Predictable metabolisable Energy MJ/kgDM	10.8	10.9	10.8	10.8

Source: British Sugar plc

Table 4: Mineral composition of dried apple pomace

Mineral	Bulmers pomace	Austrian pomace	French pomace
Total ash %	1.54	1.71	1.41
Mineral component of Ash %			
Calcium	0.12	0.08	0.12
Phosphorus	0.11	0.12	0.11
Sodium	0.02	0.02	0.03
Magnesium	0.06	0.04	0.06
Potassium	0.36	0.37	0.46
Trace minerals mg/kgDM			
Arsenic	<0.01	<0.1	<0.1
Lead	0.4	1.0	0.5
Copper	3.8	2.8	3.8
Iron	138	67	99
Fluorine	2	4	4
Sulphur dioxide	20	Nil	14

Source: British Sugar plc

Table 5: Semi In Vivo digestibility of dried apple pomace

Digestibility %	Bulmers pomace	Austrian pomace	French pomace
Organic matter			
After 4 hours	21	38	32
After 8 hours	31	37	41
After 12 hours	41	44	36
After 24 hours	58	44	62
Crude protein			
After 4 hours	9	10	9
After 8 hours	13	14	3
After 12 hours	15	9	5
After 24 hours	14	7	19
Estimated DOMD%	56.8	43.4	60.9
Estimated DCP g/kgDM	8.1	7.3	9.3

DOMD = Digestible organic matter in dry matter
DCP = Digestible crude protein

Table 6: Comparative projected market values of feeds

Feed	Metabolizable energy [MJ/kgDM]	Digestible crude protein [g/kgDM]	Market value [£/tonne 198?]
Barley	12.9	82	120.00
Soya bean meal	12.3	453	200.00
Dried pomace	10.8	8	86.62*
French pomace	10.2	75	21.38*

* Calculated values – on merchant's premises 198?

Source: Table 2