Vol. XI No. 4

October - December 2009

NEWS LETTER

OIL TECHNOLOGISTS' ASSOCIATION OF INDIA WESTERN ZONE

Inside This Issue

The New Year is around the Corner. Hopefully, economy will stabilize. In its wake, it will bring better earnings. Industry is said to be growing at 8 per cent. What does it mean to the so-called "Aam Admi".

This news letter is for free circulation only to the members of OTAI-WZ

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OIL TECHNOLOGISTS' ASSOCIATION OF INDIA WESTERN ZONE

From the Editors's Desk

HAIL THE NEW YEAR

The turmoil on various fronts in 2009 has to make 2010 a year of purposeful achievement. How? By a dedicated cultivation of strengths to accept challenges that confront all of us. And overcome them with courage and determination. We hear these homilies all thetime. But example is better than precept; as they say.

  

Trade & Commerce

MUST READ

PALM CURRENT AND FORWARD PRICE OUTLOOK*

Dorab E Mistry
Director,
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Ladies and Gentlemen

I am delighted to be speaking in the beautiful city of Istanbul under the auspices of the **Malaysian Palm Oil Council**. This region extending from the North African shores of the Mediterranean Sea, across the Middle East and right up the CIS countries, is likely to emerge as a major area for consumption of vegetable oil. Living standards are rising, population is growing, economies are expanding and prosperity is spreading. All these factors make this region an ideal ground for the expansion of palm oil. As usual the wise leadership of the Malaysian Palm Oil Council has set to work on this potentially huge markets at the right time.

In my paper today, I shall first trace the recent movements in world vegetable oil prices, explain why these happened and draw some conclusions that will assist us in understanding where market are headed in the next few months.

Recent market developments

As you all know, vegetable oil prices staged an impressive rally in the 2 months from mid March to mid May. The major reasons for this rally were:

Firstly, the severe Drought in Argentina which reduced its soybean crop from 47 million tonnes to 32 million tones.

Secondly, The USDA report of 31st March 2009 on Planting Intentions for new crop soybeans in 2009 which gave us an estimate of just 76 million acres against previous trade estimates as high as 80 to 81 million acres.

Thirdly and perhaps most importantly, Indian imports and consumption of vegetable oil soared dramatically as a result of duty free imports and consequent low prices. Low prices spurred per capita consumption in this quintessentially Price Elastic market. It is now acknowledged that Indian per capita consumption has undergone a once-in-a lifetime upward adjustment of almost 1.4 kilos per head, as a result of the removal of import duty.

Fourthly, the lean biological cycle for palm oil production extended until April 2009 and that meant production during the first 4 months of 2009 was unusually low in Malaysia as well as Indonesia. We finally saw the Biological High Cycle kick in from May onwards. In the meantime, palm oil stocks were too low for comfort and prices had to rise to control demand. ***Finally, we have not seen any significant demand destruction*** except perhaps to some extent in Mexico and in parts of Eastern Europe. It was expected that demand for bio diesel would collapse. That has not happened. As a result of mandates, both existing and new ones, bio diesel production in 2009 will be somewhat higher than in previous year.

Let Me now talk specifically about Palm : Let us look at Supply Prospects

CPO has started a powerful recovery in Malaysia from May onwards. At present, my best estimate of 2009 Malaysian CPO production is 17.73 million tonnes, about unchanged from the previous year. In case of Indonesia also, my estimate of CPO production is still 21.5 million tones.

Low Stocks – It is my view that based on annual usage in terms of domestic consumption and exports of almost 19 million tones, a stock level of 1.4 million tones is a must for the Malaysian

Paper by Dorab E Mistry, Director, GODREJ International Limited, At Malaysia – Turkey Palm Oil Trade Fair & Seminar : MPOC On 4 August 2009, The Ceylan Intercontinental Hotel, Istanbul.

palm oil industry to operate normally. We must remember that for the palm oil processing industry, this stock level of 1.4 million tonnes represents 25 days consumption and includes Raw Material and Finished Goods combined. It is very tight. ***Since the end of February 2009, palm oil stocks in Malaysia have been below this threshold and I expect them to remain below this threshold of 1.4 million tones until mid August.***

It was based on this tight stock-to-usage ratio, the general expectation of a recovery in the world economy, the looming drought India and the developing El Nino phenomenon that I made a forecast on 18 May that CPO futures would climb to 3000 Ringgits. That forecast has not verified as yet. I would like to make a few comments on the price scenario post 18 May 2009.

Around mid May, we saw in circulation a number of forecast of CPO production in the Second Half of 2009 in Indonesia and Malaysia combined. One particular set of figures made the market extremely nervous and I re-produce it here :

000 tons	Jan –Dec 2009	FH 2009	SH 2009	Increase
Malaysia	17,843	7,993	9,850	**1,857**
Indonesia	20,870	9,445	11,425	**1,980**
Total	38,713	17,438	21,275	**3,857**
Per month				**640**

In other words, these statistics painted a picture that in each month in the Second Half of 2009, from July to December, the world would have to absorb an additional 640,000 tonnes fo CPO.

Was the sell-off justified?

I believe figures such as this one, sent several analysts and traders into panic mode. Almost universally, with just one honourable exception (and he is truly a Gold plated analyst despite his young age), analysts who work for investment banks and brokerages become Bearish. The Wire Services (I normally have a lot of respect for their journalists) also got swayed by such statistics and also started writing very bearish stories. There were stories of tank-bursting stocks in India and of vessels waiting in the Middle East. This created a massive sell off in our markets and prices retracted all the way down from 2800 ringgits to almost 2000 ringgits. In my humble opinon this sell off was not justified by the then prevailing fundamentals. ***Some pressure in the market in September was reasonable but to sell the market in June was absurd***.

I also wish to comment on the new breed of trader or investor we are seeing in our markets these days. Many of these worthies would have great difficulty distinguishing Stearine from Olein. Their knowledge of the product and the industry can be written on a single clean sheet of paper and their experience can be counted on one finger. They usually respond to news as they read it and learn of it (usually for the first time) from the news wires. We saw a classic display of this when the market dropped on the day news was reported that Indonesian Export Tax on CPO would be NIL in August. Almost every experienced physical trader knew it and hand discounted it for 3 weeks. Yet on the day it was actually reported, the innocent and the unwashed sold the market !

However, at the end of the day, market is always right and we have to be adjust our stance to suit the majority of its participants. So we all have to be careful When to trade in addition to knowing How to trade. Sometimes, we may have traded some factor too soon. I believe in my earlier price forecast, I may have factored in the El Nino and the Indian drought too early.

Palm oil stocks

I would like to come back to palm oil stocks in Malaysia which are a key factor in price making. I believe stocks will replenish from mid August only. Based on information available at present and outlook for exports, I expect Malaysian palm oil stocks to expand from the end of August and peak in November at around 1.8 million tones.

Having discussed PALM S&Ds in detail , I shall now speak briefly on the other major vegetable oils.

Sunflower oil: The availability of Sunflowers oil in the Second Half of 2009 will get tighter. The massive amount of under-priced Black Sea sunflower oil which was available December and March is a thing of the past.

From early 2010, ! expect Sunflower oil to command a significant premium to soya oil. This is also the considered opinion of my friends at **Oil world** – a publication that I have read and studied with great respect over the last 30 years.

Rapeseed oil: Rapeseed production is turning out to be better than expected in most parts of the world. We must however bear in mind that the threat of frost damage in Canada should not be overlooked in the next several weeks. The fate of the Indian Rapessd crop, which is planted in December and harvested in March is still uncertain. Usually in EI Nino years, when the Kharif crop (harvested in November) in India fails, the Rabi crop (harvested in March) does very well. However, this will depend on late season rains in September and how much India's reservoirs are filled. On the other hand, the elimination of Splash & Dash has given the European bio diesel industry a new lease of life and revived demand for Rapeseed oil . Therefore, Rape oil will remain a premium oil and command a premium to soya oil.

That brings me to **Soya oil**. As a result of the shortfall in South American crops in 2009 and the strong demand for beans from China, current world stocks of soybeans are extremely tight. Recent trading in Chicago soybeans futures bears this out.

My friend Anne Frick, senior oilseed analyst at Prudential Bache has recently prepared an excellent table of Potential Supply of Soybeans as on 1st September 2009. I take the liberty of summarizing it thus;

1st September 09 Stocks - 000 tons	**2008**	**2009**
Argentina	25,084	17,465
Brazil	24,546	17,106
Total including USA	**55,209**	**37,785**
Add: U S crop (2009 est.)	80,536	89,595
Potential Supply on 1st September	131,198	122,930

From this table it can be seen that actual physical stocks of beans are lower this year by almost 18 million tonnes. It gives an idea just how tight the situation will be in South America with regard to soybeans and their products – meal and oil. It will translate to extremely strong export demand for beans and meal in USA during the period September 09 to February 2010.

Let us now look at DEMAND

On the DEMAND side, we must expect the new higher level of per capita consumption in India to continue at least until for the foreseeable future. India will continue to import between 650,000 and 700,000 tonnes per month until October 2010. That would give us a total for imports for the oil year November 2008 to October 2009 of least 8.5 million tonnes. The newly elected government in India has not levied any additional import taxes on vegetable oil. The developing drought situation makes it extremely unlikely that any new import taxes will be imposed until November 2009.

As a matter of interest and to counter the extreme bearish picture of palm that was being earlier circulated, I am repeating my earlier prognosis of the break-up of imported oils into INDIA.

000 tonnes	**2008-09**	**2007-08**	**2006-07**
Soya oil	1000,000	750,000	1335,000
Palm	6750,000	5270,000	3665,000
Sun oil	500,000	30,000	200,000
Lauric oils	200,000	200,000	200,000
Vanaspati	50,000	50,000	215,000
Total	**8500,000**	**6300,000**	**5615,000**

Before I discuss the Incremental S&Ds of the world, let me caution you that Swine Flu is something that I have not taken into account in this analysis. I pray to God that Swine flu will soon be controlled and will not hurt humanity.

Global Incremental S&Ds

I have also not altered my forecast of Global Incremental Supply in 2008-09. However, in terms of time scale, the first half of the year saw an increase in supply of sun oil and Rape oil whilst Palm oil supply actually contracted. Now in the Second Half, Palm oil supply will accelerate. The greater volume

of palm will be required to satisfy the bigger demand in the second half coming from the festival season in India, from Ramzan demand and the acute tightness in soya.

We can see the Global Incremental Supply and Demand as follows :

000 tonnes	2007-08	2008-09
Soya oil	+ 1200	- 1500
Rape oil	+ 500	+ 1400
Sun oil	- 1000	+ 1500
Palm oil	+ 4500	+ 1500
Lauric oils	+ 450	+ 200
Total Supply	+ 5640	+ 3100
Demand	+ 4500	+ 4500

PRICE OUTLOOK

As I have said previously, the sell-off June was not justified by the fundamentals. ***Palm oil prices are rallying and I expect them to trade in a range between 2100 and 2300 Ringgits for the next few weeks.*** There is no reason for prices to decline because stocks are still tight. The inverse in the price of RBD Olein says it all. If when stocks begin to expand, possibly in September, price will gradually decline and may touch 2000 Ringgits. Should prices decline, it will be a buying opportunity.

A lot will depend on the cross rate between the US Dollar and the Rupiah and also the cross rate between the US Dollar and the Ringgit. Strength in the Rupiah will be constructive for Ringgit prices.

We shall also need to watch development on the El Nino front. The latest information suggests we are due to have amid El Nino. If that is the case, CPO production will suffer in the first half of 2010. The periods of dry weather in Indonesia and Malaysia will begin to make sentiment quit bullish from October-November onwards. **Depending on the strength of the El Nino, the rally tends to start around August if it is severe and around October-November if it is mild.** An El Nino inspired rally would come on the back of extremely tight soybean supplies. Since the El Nino itself is still developing it will not be wise for me to make a price forecast for that period yet.

Indian Monsoon Rains

As regards the failure of the Kharif Indian monsoon, I shall speak in more detail at **my next paper which will be on 27 September at Globoil India in Mumbai.** However, I must caution those who are getting a bit carried away by the current drought in India. We must remember that India only produces between 3.5 and 4 million tonnes of vegetable oil from its kharif season crops. In this estimate I am including Rice Bran oil. The combined production of vegetable oil from soybeans and groundnut is less than 2 million tonnes on average. Even if these crops are very badly affected and production declines 20 percent, it will only mean a shortfall of 400,000 tonnes. In the overall context this is not a big deal. If prices of food grains, vegetable and staples rise as a result of the drought, India's famous Price Elastic Demand will take care of the shortfall and India may not need to increase vegetable oil imports by much.

Sentiment in the domestic market in India today is red hot. It is justified. Indian traders are indulging in what Mr. Greenspan would have called "irrational exuberance " We now live in an open market and world supplies of vegetable oil are ample to take care of the shortfall in India. The bigger problem for India is the inability of its importers to bring in adequate supply of Pulses. These imports are chiefly undertaken by public sector companies. If you recall, these public sector companies were the biggest Defaulters in 2008 when price collapsed. There is an old truth "As you sow, so you reap" the crisis in the importation of Pulses, and the consequent sky high prices paid by the hapless Indian consumer are the direct result of earlier Defaults by Indian public sector companies.

Finally, two other factors will play a role in price making.

CHINA: china will remain a large but enigmatic factor in the market. So far, the actions of the Chinese government in ensuring high domestic price levels to help local farmers have benefited the world price level. It is probable that such supportive action will continue over the next several months and will continue to benefit world prices. **Secondly, the**

behaviour of the world economy and the timing of the recovery will play an important role. At some stage in late 2009, the economies of the Developed World will begin to grow again. The psychological impact of that turnaround could be to the benefit of prices.

Conclusion

To sum up therefore, I believe Palm oil prices do not need to fall in the next few weeks and may in fact rally. If and when Stocks expand, prices will decline but 2000 Ringgits will be a very strong support. Prices at such a level are more of Buy than a Sell. And finally, once the period of peak production and stocks has passed, prices can resume their recovery. This year the Weather Gods are all important. I shall comment on the market each month from now, firstly in Mumbai at Globoil, then in Capetown at AFROIL, then in Guangzhou at CIOC and finally in Bali at GAPKI.

I once again thank the **Malaysian Palm oil Council** for inviting me to speak at this POTS conference in Istanbul.

Good Luck and God Bless

Import of Vegetable oils Up by 39% in Third Quarter of the Oil Year 2008-09

Import of Vegetable Oils during third quarter of year 2008-09 is up by 39% and import during July'09 is more or less same as of the last year and reported at 596,024 tons compared to 571,395 tons for July'08. Overall import of vegetable oil during Nov.'08 to July'09 jumped by 55% to 6,419,888 tons from 4,138,518 tons for the same period if last year.

Import of Vegetable Oils – Nov. '08 – July '09

(Qty. in M. T.)

Month	2008-09			2007-08			% Change
	Edible	Non-edible	Total	Edible	Non-edible	Total	
November	519,032	36,310	555,342	347,320	80,592	427,912	+ 30%
December	719,125	26,438	745,563	276,782	28,494	305,276	+ 144%
January	856,690	31,412	888,102	457,601	55,652	513,253	+ 73%
Nov.-Jan.	**2,094,847**	**94,160**	**2,189,007**	1,081,703	164,738	1,246,441	+ 76%
February	730,094	32,450	762,544	430,992	84,237	515,229	+ 48%
March	609,553	31,588	641,141	421,686	81,141	502,827	+ 28%
April	659,477	39,919	699,396	309,629	37,703	347,332	+ 101%
Feb.- April	**1,999,124**	**103,957**	**2,103,081**	1,162,307	203,081	1,365,388	+ 54%
May	696,625	54,472	751,097	302,345	59,219	361,564	+ 108%
June	742,481	38,198	780,679	550,201	43529	593,730	+ 31%
July	557,423	38,601	596,024	532,456	38,939	571,395	+ 4%
May-July	**1,996,529**	**131,271**	**2,127,800**	1,385,002	141,687	1,526,689	+ 39%
Total (Nov.-July)	**6,090,500**	**329,388**	**6,419,888**	3,629,012	509,506	4,138,518	+ 55%

Monsoon Performance

This year's monsoon in India is likely to be the poorest in many years. Precipitation remained significantly below normal so far in August. It is feared that production of Kharif crops will suffer a major setback this year as the dryness has partly prevented plantings and will also curb the yield potential massively. This is likely to lead to lower production of oilseeds and reduced domestic oil availability in next oil year.

Drought-like conditions have spread further and are meanwhile affecting one third of the country . During June 1 to August 5 cumulative rainfall was 25% below the 50 years average according to the India Meteorological Department, which forecast rainfall in August to be 10% below normal. Rainfall deficits of at least 20% were registered so far this season throughout central and nortern India, with the largest deficits in the north-east states.

Acerage, as on 6th August of groundnut is worst affected and reported at 35.7 lakh hectare only compared to 45.5 lakh hectare last year at the same time. Soybean acreage marginally increased to 93.7 lakh hectare compared to 91.3 lakh hectare last year. Cotton has gone up considerably and reported at 92.9 lakh hectare compared to 79.5 lakh hectare. Oilseeds production will be depend on how the monsoon behaves in August & September.

The erratic monsoon and likely lower Kharif oilseeds crop will further push the import in Sept/Oct months and overall imports likely to be about 80 lakh tons (75.0 lakh edible oil + 5.0 lakh mon edible oil) for the current oil year ending Oct'09 compared to 63.0 lakh tons import during last year.

KING COTTON

Cotton is Kharif King in Gujarat

Gujarat, which reported a record 9.6 per cent growth in agriculture last year, the State now produces more marketing than for own consumption. Although the Kutch-Saurashtra regions, which usually remained arid in rainy seasons until some years ago, have received 20 per cent excessive rains this year so far, the authorities are worried over the changing crop patterns in these areas even as other parts – North, Central and South Gujarat – are almost drought-affected due to less than normal rains.

Till now, almost 81 lakh hectares have been brought under the plough in Gujarat against the 87 lakh hectares expected before the onset of the monsoon. Official sources told Business Line that the area under cotton this year has increased by nearly two lakh hectares to 25.52 lakh hectares this year from 213.82 lakh hectares on the expense of other crops, especially oilseeds. Of the 26 districts, 11 received 40 per cent less than normal rainfall.

(Source : the Hindu Business Line dated18th Aug'09)

NOT A SMOOTH RUN

Castor Oil

The economic crisis has severely hurt castor oil demand in the EU-27, the US and Japan, but much less so in China. India In Jan/May 2009 EU Castor oil imports declined by as much as 41% and US imports by 37%.

Chinese imports rose to a multi-year high of 14 Thd T in June, leading to a stagnation of arrivals at 50 Thd T in Jan/June 2009. Japanese castor oil imports fell by 57% to only 4.5 Thd T in Jan/June 2009. Castor oil imports from Thailand were cut in half to only 4 Thd T in Jan/June 2009.

Castor oil stocks in Europe were reduced massively as a result of the low imports. Stocks in France dwindled from more than 23 Thd T in late 2008 to roughly 2 Thd T at the begining of June according to our estimates. EU castor oil imports started to increase already in May and recovery of import demand is likely to continue in subsequent months.

Tight stocks in Europe have contributed to a firming of castor oil prices in Rotterdam at US- $ 1250-1270 in May/July 2009, about 30 % less than a year ago. The price firmness has been magnified by reserved selling in India where stocks of castorseed are still relatively large as a result of subdued demand so far this year. The selling policy and the price formation in coming weeks will be strongly determined by Indian crop prospects.

Castor Oil : Imports of Major Countries

(1000 T)

	Jan/May	Jan/Dec
EU-27	36	163
U.S.A.	15	50
	Jan/June	**Jan/Dec**
China, PR	50	84
Japan	5	19
Thailand	5	17
Grand Total	111	333

(Source: Oil World Weekly, July 31,2009 Internet: www.oilworld.biz.)

SPECTACULAR

Cotton National

Spectacular rise in Cotton Production inspite of service drought

Cotton Advisory Board in its meeting held on 29th August, 2009 has estimated that cotton production during the current year 2009-10 as 305 lakh bales (bale 170 kg each) The Cotton Corporation of India has estimated production as 310 lakh bales where as the Cotton Association of India (formally East India Cotton Association) has estimated production 315 lakh bales. We have observed for the last ten years that the trade estimated in the beginning of the season is generally on higher side. Therefore, AICOSCA is inclined to accept CAB's Cotton production estimated during the current year 2009-10 as 305 lakh bales.

No Service Tax On Commission Paid To Managing Director / Directors for their Managerial Function

Circular No. 115/09/2009 – ST

Dy. No. 324/Comm (ST)/2008
Government of India
Ministry of Finance
Department of Revenue
Central Board of Excise and Customs

New Delhi, 31st July 2009.

Subject: Service tax on commission paid to Managing Director / Directors by the company – reg

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Below mentioned issues have been referred to the Board seeking clarifications,-

(i) applicability of service tax under 'Business Auxiliary service' on commission paid to Managing Director / Directors (whole, or Independent) by the company,

(ii) applicability of service tax on Independent Directors who are parts of the Board of Directors under 'Management Consultant service '-

2. Both the matters have been examined by the Board and the clarifications are as under,

(i) Some Companies make payment to Managing Director/ Directors (Whole-time or Independent), terming the same as 'Commissions'. The said amount paid by a company to their Managing Director / Directors (Whole-time or Independent) even if termed as commission, is not the 'commission' that is within the scope of business auxiliary service and hence service tax would not be leviable on such amount.

(ii) The managing Director / Directors (Whole-time or Independent) being part of Board of Directors perform management function and they do not perform consultancy or advisory function. The definition of management consultant service makes it clear that what is envisaged from a consultant is advisory service and not the actual performance of the management function. The payments mode by Companies, to Directors cannot be termed as payment for providing management consultancy service. Therefore, it is clarified that the amount paid to Directors (Whole-time or Independent) is not chargeable to service tax under the category 'Management Consultancy Service '. However, in case such director provide any advice or consultancy to the company, for which they are being compensated separately, such service would become chargeable to service tax.

3. In view of the above, it is clarified that remunerations paid to management Director / Directors of companies whether whole-time or independent when being compensated for their performance as Managing Director / Directors would not be liable to service tax.

Pending issues may be resolved in line with the above.

Yours faithfully
Sd/-
(Himanshu Gupta)z
Commissioner (Service Tax)
CBEC, New Delhi

State wise production estimate is given below:

State wise Production of Cotton

(Production: lakh bales of 170 kg each)

State	Production	
	2009-10	**2008-09**
Punjab	17.00	17.50
Haryana	16.00	14.00
Rajasthan	10.00	7.50
Total North zone	**43.00**	**39.00**
Gujarat	95.00	90.00
Maharashtra	66.00	62.00
Madhya Pradesh	18.00	18.00
Total Central zone	**179.00**	**170.00**
Andhra Pradesh	53.00	53.00
Karnataka	11.00	9.00
Tamil Nadu	5.00	5.00
Total South Zone	**69.00**	**67.00**
Others	2.00	2.00
Total	**293.00**	**278.00**
Loose production	12.00	12.00
All India	**305.00**	**290.00**

(Source: Cotton Advisory Board, Min. of Textile, Govt. of India,)

Cotton area reached about 100 lakh hectares during the current year

On 29th August, 2009 the meeting of the Cotton Advisory Board, (CAB) Min. of Textiles, Govt. took place. In this meeting Mumbai based the Directorate of Cotton Development, Min. of Agril. Govt. of India, has informed that the estimated cotton area during this year 2009-10 is 96.55 lakh heactares. The said cotton area may further increase by about two lakh hectares taking final estimate of area to 98.28 lakh hectares as compared to 94.06 covered during the year 2008-09. In the same meeting, chairman Cotton Corpration of India informed that based on crop surveillance report received by various branches 103.78 lakh hectares. CAB has not taken any; view on this. Based on the above, AICOSCA is estimating that area under cotton during the current year would be about 100.00 lakh hectares as compared to 94.14 lakh hectares covered during last year. The Statement Area is given below.

State wise Area under cotton

(Area; lakh hectare)

State	Area	
	2009-10	**2008-09**
Punjab	5.36	5.27
Haryana	5.20	4.56
Rajasthan	4.44	3.02
Total North Zone	**15.00**	**12.85**
Gujarat	28.00	23.54
Maharashtra	32.95	31.42
Madhya Pradesh	6.64	6.25
Total Central Zone	**67.83**	**61.21**
Andhra Pradesh	13.19	13.99
Karnataka	2.92	4.08
Tamil Nadu	0.28	1.09
Total South Zone	**16.39**	**19.16**
Orissa	0.54	0.58
Others	0.24	0.26
Total	**0.78**	**0.84**
All India	**100.00**	**94.06**

Cottonseed Production

Based on the production of cotton estimated on production of cotton seed has been worked and given below:

Estimated Production of Cottonseed

(In lakh tones)

State	2009-10	2008-09
Punjab	5.66	5.83
Haryana	5.33	4.66
Rajasthan	3.33	2.50
North zone	**14.32**	**12.99**
Gujarat	31.64	29.97
Maharashatra	21.98	20.65
Madhya Pradesh	5.99	5.99
Central zone	**59.61**	**56.61**
Andhra Pradesh	17.65	17.65
Karnataka	3.66	3.00
Tamil Nadu	1.67	1.67
South zone	**22.98**	**22.31**
Others	0.67	0.67
Total	**97.57**	**92.57**
Loose Production	4.00	4.00
All India	**101.57**	**96.57**

(Source: All India Cottonseed Crushers' Association)

Availability of Cottonseed for Processing

	09-10	08- 09
1. Cotton Production (Lakh bales)	305	290
2. Cottonseed Production (@333kg/bale) (lakh tonnes)	101.57	96.57
3. Retained for sowing & Direct Consumption (lakh tonnes)	5.00	5.00
4. Marketable Surplus (lakh tonnes)	96.57	91.57
5. Production of Washed Cottonseed Oil (Lakh tonnes)	11.59	10.99

(Source: All India Cottonseed Crushers' Association, Mumbai.)

Organic Cotton Production and Markets Continue to Grow

According to Organic Exchange (OE), the demand for, and supply of organic cotton grew dramatically in 2008, indicating strong interest from the global retail markets and interest from farmers in growing cotton organically. OE's October 2008 report, Organic Cotton Farm and Fiber Report 2008, shows that the amount of organic cotton grown worldwide in 2007/08 increased to 145,872 metric tons (MT), or 668,581 bales, a 152% Increase from 2006/07.

Organic cotton now represents 0.55% of total global cotton production, a staggering increase considering the relative infancy of the industry.

Organic Market Growth

Some of the world's largest companies are now committed to organic cotton, including Walmart, Nike and C&A. In fact, the incorporation of organic fiber into product lines has become the norm, rather than the exception. Demand particularly in the North American and European markets has driven this trend and will likely continue to do so. The markets has experienced exponential growth for a number of reason. The foremost reasons are improved consumer awareness of sustainability issues and innovative thinking on the part of brands and manufacturers about the social and environmental impact of their products. Companies are making sustainability a core part of their business models.

Future Challenges

Despite the explosive growth of the organic cotton industry during the last decade, the industry faces challenges in the years to come. The most speculated about is the slowing global economy. To be certain, the rapid growth of the organic cotton industry will slow, but many companies believe that the organic cotton industry will nonetheless continue to get stronger.

The research suggests that when faced with economic uncertainty, consumers were likely to reach for products that demonstrated greater value, even when more expensive. It is clear that the organic cotton market, with global production increasing and renewed commitment to organic fiber use from companies representing all different focuses and demographics, will likely continue to grow.

Courtesy : (CAI: Cotton Statistics & News. 7th July, 2009)

REVISIT KING

Processing of Cotton

Traditional method

Cottonseed cake can be processed either in a scientific manner by way of delinting / decortication etc., or simply by traditional crude method of crushing seed without delinting in undecorticated form. MORE THAN 95 PERCENT OF THE COTTONSEED PROCESSED IN THE COUNTRY IS BY THIS TRADITIONAL (crude) method. The oilcake obtained by the traditional method contains about 6 percent oil which is virtually not required by the cattle. Further, the protein content, considered as vital nutrient for raising the milk yield/maintaining healthy growth of the cattle is considerably low i.e. 20 to 22 percent in undecorticated cotton seed cake. IT IS A MYTH THAT OIL CONTENT IN THE COTTONSEED CAKE RAISES MILK YIELD OR FAT PERCENTAGE IN THE MILK, Oil is generally required for generation of energy. The ruminant have a specialised digestive system with compound four compartment stomach. The energy is generated while cattle carries on rumination of the

fibrous portion of the feed. Therefore, the oil content in oil cake is virtually not of much use to the cattle.

We are also wasting about 2.5 lakh to 3.00 lakh tonnes of cotton linters every year due to traditional method of cottonseed processing. Besides physical loss, delinted cottonseed fetches higher oil yield and the quality of oil also improves. Presence of cotton linters reduces the protein content in the cottonseed cake which is a serious loss considering our protein starved cattle population.

The bulk density of cottonseed (undelinted) is about 40 percent more than the delinted cottonseed. Thus about 40 percent more seeds could be transport and stored in the same area if delinted.

It is reported that in China there is an in-built system of delinting cottonseed after ginning. There is an urgent need to adopt this system in India to prevent loss or cotton linters and also save the cost of transportation of seed. The cotton linters can also be pressed by the same baling press used for pressing cotton lint. This will provide additional work to the ginning and pressing factories which have short span of working.

Scientific processing of Cotton Seed :

Scientific processing of cottonseed broadly involves removal of linters, decortications, separation of hull, expelling, solvent extraction and refining of oil. Such processing ensures securing almost the entire cottonseed oil (about 16.5% of the total oil content of about 18%) from the cottonseed. The cottonseed meal/extraction obtained by this method contents protein as high as about 40 to 42% as compared to about 20 to 22% in traditionally prepared cottonseed cake. The protein contents in the cattlefeed is best utilised by the cattle if it by-passes its rumen (first part of the stomach) and is digested in the subsequent parts of the stomach. SUCH PHENOMENA IS KNOWN AS "BY-PASS PROTEIN". IT HAS BEEN ESTABLISHED THAT THE PROTEIN CONTENT IN COTTONSEED EXTRACTIONS IS OF "BY-PASS PROTEIN" TYPE.

DECORTICATED COTTONSEED EXTRACTION IS RECOGNISED ALL OVER THE WORLD AS BETTER CATTLE FEED. IN FACT, UNDELINTED UNDECORTICATED COTTONSEED CAKE IS VIRTUALLY AN UNKNOWN PRODUCT IN THE DEVELOPED COUNTRIES. Cottonseed extraction has also two other uses vi. Fish feed and Poultry feed. Based on the experience abroad, there is good scope for export of cottonseed extraction as cattle, fish and poultry feed subject reducing Gossypol content. Based on loss of cottonseed oil, linters, hulls and soap stock due to traditional processing, total losses of these by-products have been worked out and given in the following table.

ESTIMATED LOSSES DUE TO TRADITIONAL PROCESSING OF COTTONSEED

(Unit : Qty. Lakh tonnes) (Value: Rs. Crores)

		2007-08		2006-07		2005-06	
1.	Availability of cottonseed for processing	91.90		81.26		65.59	
2.	Cottonseed Processed Scientifically	3.80		3.05		3.06	
3.	Percentage of quantity Processed Scientifically to the total availability of cottonseed for processing.	4.13		3.75		4.66	
4.	**Estimated Annual Loss due to traditional processing :**	**Qty**	**value**	**Qty**	**value**	**Qty**	**value**
I]	Cottonseed Oil (7%)	6.17	2946.48	5.47	2286.00	4.38	1592.87
II]	Linter (4%)	3.52	607.69	3.09	370.80	2.50	300.00
III]	Hulls (27%)	23.79	805.00	20.85	688.05	16.88	557.04
IV]	Soap Stock (0.8%)	0.70	25.36	0.61	21.35	0.50	19.00
	Total Losses	**34.18**	**4384.53**	**30.02**	**3348.20**	**24.26**	**2468.91**

Value addition

Based of what has been stated earlier, value addition by cottonseed products is estimated as follows.

Value addition of cottonseed by-products

		Quantity (lakh tonne)	Value (Rs. Crores)
i	Cottonseed Oil	5.5 to 6.00	2750 to 3000
ii	Cotton linter	3.00 to 3.50	350 to 425
iii	Hulls	20.00 to 24.00	700 to 800
iv	Soap Stock	0.50 to 0.70	20 to 25
Total		**29.2 to 34.2**	**3800 to 4250**

The contents of the above table reveal that we can easily add about 29 to 34 lakh tonne of cottonseed by-products worth about Rs. 3800 to 4250 crores every year.

Value addition from Cottonseed cake/Extraction

About 95 percent of the cottonseed processed in the country is through traditional method yielding cottonseed cake with oil content between 6 to 7 percent and low protein content of about 20 to 22 percent. Cottonseed extraction (popularly called De-oiled cake) which is the end product of scientific processing contents negligible oil but protein contents as high as about 40 to 42 percent. The protein content in the cattle feed is best utilized by the cattle if it by-passes its rumen (first compartment of stomach) and is digested in the subsequent part of the stomach. This phenomena which avoids degeneration of protein in rumen and thereby help in maximum utilization of protein content in the feed, is called 'by-pass protein' Cottonseed meal is good source of natural by-pass protein and is a good source of essential amino acids like lysine methionine and origin (Garg MR/ Bhandari BM – 2007)

Several researchers throughout the world have shown usefulness of Cottonseed Extraction as an important source of by-pass protein supplement. Many feeding trials have been conducted world over with different levels of cottonseed meal in the ration of growing and lactating animals demonstrating impact on the productivity. In most of the feeding trials, daily milk yield on cottonseed meal supplementation increased by 0.6 to 1.2 liters and fat by 0.2 to 0.3 percent. On an average net daily income increased by Rs. 6.7 per animal when 1 kg. of cottonseed meal is replaced with the traditional feed, (Garg MR/Bhandari BM-2007).

At present about 95 percent of the cottonseed yield low protein cottonseed cake since it is processed in traditional method. Based in the availability of cottonseed for processing during the current year 2008-09, as about 84 lakh tonnes, we many produce about 65 lakh tonne of cottonseed cake with protein production of 13.65 lakh tonne. However, if the above available quantity is subjected to scientific processing as a measure of value addition, it would yield about 43 lakh tonees of cottonseed extraction (besides additional oil, liners, hull etc.) with protein production of 17.63 lakh tonnes. Thus, about 4 lakh tonne of additional protein can be gained which is substantial amount especially for a country like India having largest cattle population in the world, mostly protein starved.

As per the research report of the National Dairy Development Board, daily milk yield on cottonseed meal supplementation increased by 0.6 to 1.2 liters and fat by 0.2 to 0.3 percent. On an average net daily income increased by Rs. 6 to 7 per animal when 1 kg of cottonseed meal was replaced by the traditional feed (Garg MR / Bhandari BM – 2007). Based on this, value addition through cottonseed meal may be 25 lakh to 50 lakh liters in terms of milks, 8.6 to 13.9 lakh in terms of flat percentage and Rs. 25.8 to 30.1 crore in terms of total monatory gain per annum for the milk producers.

Development Strategy for value addition

It has now been an accepted fact that no extension efforts have been made so far by the Govt. agencies in gainful utilization of cottonseed and its by-products. In spite of operation over a decade both Technology Mission on Oilseed & Pulses (TMOP) and Technology Mission on Cotton (TMC) have not included development of cottonseed in their programmes, infact, it is reported that Govt. could not yet decide whether cottonseed should come under TMS or TMOP although these programme have come to an end after operating over a decade. This is a tragic happening inspite

of repeated request from the industry. The Extension work has only been done by private organization. The extension work already undertaken by the All India Cottonseed Crusher's Association. (AICOSCA) a public trust is summerised below:

AICOSCA efforts in propogating scientific processing of cottonseed

The All India Cottonseed Crusher's Association (a Public Trust) has launched an effective campaign for adoption of scientific processing of cottonseed virtually single handedly. A film on scientific processing of cottonseed was prepared in collaboration with the Council of Scientific & Industrial Research (CSIR) and the Technology Mission on Oilseeds and Pulses (TMOP) and distributed amongst various organizations. The film was subsequently dubbed in four regional languages viz. Telgu, Tamil, Gujarati & Marathi. Educative literature in the form of three pamphlets viz. 'Scientific processing of Cottonseed', 'Cottonseed – a Golden Goose' and 'AICOSCA in the Service of the Nation' were published in Hindi, Gujarati, Telgu and English and distributed all over the country. Cottonseed extraction is mainly used as cattlefeed. However, higher protein content makes it useful as poultry and fish feed also. Therefore, to explore the possibility of its uses in these new avenues, a seminar on 'Use of Cottonseed Extraction as Poultry Feed' was organized at hyderabad – a poultry capital of the country in collaboration with the ANG Ranga, A.P. Agriculture University Hyderabad. A Seminar on "Cottonseed Extraction as Fish Feed" was also organized with great success at Vijaywada (A.P.) in collaboration with the Central Institute of Fisheries Education (CIFE) ICAR, Government of India, and the Department of Fisheries, Government of Andhra Pradesh. About 50 fish farmers / feed brokers, 10 fisheries, scientists, fisheries consultant and major cottonseed processors attended this seminar. Fish farmers actively participated in the deliberations.

Almost a dozen of papers on scientific processing of cottonseed were also presented by this Association at various seminars organized by the cotton and vegetable oil Industry.

A Delegation of seven leading members of the AICOSCA visited the USA in August, 2006 for studying the operation of processing plants using modern machinery in USA and also interactive meeting with M/s. Carver Inc, USA and CentreII International (A.C. Horns & Co.) Dells. texas USA, the world's leading manufacturer of complete range of cottonseed delinting, dehulling and other oilseed processing machinery.

A National Seminar on 'Emerging Potential of Cottonseed and its by-products' was organized at Mumbai on 10th April, 2007 in collaboration with the Central Institute for Research on Cotton Technology (CIRCOT) ICAR, Government of India and the Indian Society for Cotton Improvement. The Seminar was spread over three technical sessions Viz. Cottonseed oil Production Scenario; Cottonseed by-products and Roadmap for Cottonseed Utilization Pattern. The seminar was inaugurated by Dr. Mangala Rai, Director General, Indian Council of Agricultural Research and Secretary, Department Agriculture Research, Government of India. AICOSCA presented three papers at this seminar.

On request from the Technology Mission on Cotton, Ministry of Agriculture, Government of India, a National Level Training Programme (NLT) on "Cottonseed & its by-products" was organized by the Association at Guntur on 21st & 22nd February, 2008 State Government officials form Andhra Pradesh, Madhya Pradesh, West Bengal, Orissa etc. participated in this training programme.

Field visit for the students of oil Technology of the Institute of Chemical Technology, Mumbai University was also organized on 6th and 7th December 2007 to expose students to reality of scientific processing.

Cottonseed is grown in as many as ten states in the country. However, the ignorant processors and cattle feeders are spread over the length & breadth of the country. Educating them is a huge task which can not accomplished by a public trust and a trade organization like AICOSCA. Active participation of the Government, both the State and Central Government is considered essential to save the precious cottonseed oil achieve production potential and effective utilization of other valuable cottonseed by-products like linters, hull, cottonseed extraction etc. Specific line on which extension efforts are needed is summerised below:

EXTENSION SUPPORT

Make specific processing economically viable

As explained earlier, scientific processing of cottonseed does not appear economically viable at present. This is mainly because of ignorance of the cattle feeders which can be removed by launching an effective wide spread extension campaign by the Central & State extension agencies, in collaboration with the trade & industry. Since there is considerable gestation period for such campaign to yield desired result, some monetary incentive is needed in the initial year for change over from traditional to scientific processing. We do not need Government money for running our industry. However, monetary incentive may facilitate shifting from traditional to scientific processing expeditiously in the larger National interest.

Modernisation of processing machinery

Most of the cottonseed processed in the country is through traditional ghani or expeller. Machinery used even where cottonseed is processed in a scientific manner is also quite old and inefficient. Delinting and dehulling are two important steps in processing cottonseed in a scientific manner. Comparative cost of operation of the existing as well as modern machinery for delinting comes to about Rs. 64.01 lakh and 37.42 lakh, respectively. For de-hulling machines the comparative costs for traditional and modern machinery of 150 metric tonnes per day capacity comes to about Rs. 24.18 lakh and Rs. 15.30 lakh, respectively. This comparative cost analysis underlines the urgent need for replacing the existing age old processing machinery with modern cost effective machinery which is now easily available in India through American collaboration

Delinting Seed – Adoption of China Pattern

It is reported that in China there is an in-built system of delinting cottonseed after ginning. This practice not only yields a large quality of oil as well as higher recovery of oil. The Bulk density of cottonseed (undelinted) in about 40 percent more than the delinted cottonseed. Thus, about 40 percent more seeds could be transported / stored in the same area if seeds are delinted.

It is urgently necessary to adopt this practice of delinting seed immediately after ginning of cotton to reap the above benefits. This aspect can form an integral part of the existing scheme on modernization of ginning factories being executed by the Technology Mission on Cotton.

Putting statutory restriction on crude method of processing is also one way.

Use of cottonseed extraction in compound cattle feed

We are passing through a fast changing era of animal nutrition when traditional cattle feeds are being replaced by the nutritionally balanced compound cattle feed. The compound feed manufactured will do a yeoman service to the nation by using larger quantities of proteinous cottonseed extraction (Deoiled cake) in manufacture of compound cattle feed, fish feed and also poultry feed. It would encourage scientific processing of cottonseed and there by reduce enormous national loss of cottonseed by-products caused by to traditional processing. Initially there may be problem of adequate availability. However, once the demand is generated production would chase the demand automatically.

Research on support

Most of the research work on cotton has so far been confined to cotton lint which forms only 1/3rd portion of the seed cotton. We need to have need based research on cottonseed especially for enhancing the oil content, reducing gossypol contents etc. The specific aspects on which research need to be directed are as follows:

i) Increase in seed yield per hectare,
ii) Increase in oil percentage,
iii) Reduction in gossypol content,
iv) Increase protein percentage,
v) Increase lysine content,
vi) Better resistance to micotoxine,
vii) Use of Cottonseed (meat) as protein food based on the recent research in USA,

Conclusion

The current year 2008-09 is probably to best year to reiterate need for value addition in cotton.

With the sudden rise of minimum support prices of lint by as much as about 40 percent, there is turmoil is cotton industry. We are virtually priced out in the international market both in terms of raw cotton and finished products due to spurt in lint prices. Estimation of export of raw cotton this year has been drastically reduced to about 50 lakh bales. While farmers do need higher prices, nevertheless the industrial product like lint should not cost, so much to make the industry in-competitive in the international market. Therefore, there lies a crucial need to adopt non-price measures like value addition to balance the interest of all players in the game i.e. producers, trade & industry. Cottonseed provides maximum scope in this respect.

Source : AICOSCO Newsletter, Pg 9 to 13.

TRAPPED

Adulteration trips up vanaspati ghee manufacturers

The Rs. 5000 – crore vanaspati ghee industry is facing an enemy within Refined palm stearin, a mon-edible by-products of crude palm oil, is being used as an adulterant in cheap vanaspati, denting the business of genuine manufacturers.

A senior official at the Directorate of Prevention of Food Adulteration (PFA) confirmed that regulations did not permit the use of stearin in the making of vanaspati ghee but declined to comment further. Stearin is largely used to manufactures soaps. However, soap manufacturers prefer imported stearin or palm fatty acid which is cheaper. This has caused domestic producers of stearin to divert their product for edible purposes into the vanaspati ghee industry.

The practice is also being patronised by some large stearin manufacturers who pass off stearin labelled as crude palm oil to these units. These manufacturers either mix stearin with edible oil to bring down the melting point or are directly pack and sell it as vanaspati, according to Adhiraj Sarin, MD, Bunge India, manufacturer of the famous Dalda brand of vanaspati ghee.

Siraj Chaudhry, MD (refined oils), Cargill agrees that adulteration possibly happens on a large scale in the lower-price brands. “It allows companies to dispose of stearin which they cannot use in the normal process for financial benefit. Some large manufacturers are also doing this and selling such vanaspati in their lower placed brands.”

According to rough estimates by the industry, genuine vanaspati is about Rs. 13 per kg more expensive then adulterated vanaspati. “This is making life difficult for those who follow the law,” said Mr. Chaudhry.

The adulteration version of the vanaspati has a melting point that is much higher than the mandated 41 degrees by PFA. “Perhaps over 90% of vanaspati being sold in the market violates melting point specifications of PFA. This is a huge problem and is affecting the genuine manufacturers of vanaspati,” said Mr. Sarin.

The adulteration vanaspati is being widely sold in states such as Uttar Pradesh, Rajasthan, Bihar and West Bengal. Several prominent traders and heads of vanaspati associations too have spoken about this practice, but are not willing to come on record. However, Indian Vanaspati Producers Association president JK Khaitan said that his members were not involved in such malpractices. “Neither is any member involved nor has anyone come forth with any such case being practised,” he said. Industry sources say a million tonnes of stearin is being passed on as vanaspati which is used as a substitute for pure ghee.

Joy Cheenath, joint secretary, ministry of food and consumer affairs, was not available for comment. D Panda, joint secretary, ministry of health, said the matter has not been brought to his notice and the department would initiate action if such cases came to light.

(Economic Times 8th April, 2009)

TOO BAD

Oilmeal exports drop 64% in April

Meat production falls; slowdown in poultry sector

A decline in meat production in Europe, the US and other countries and slowdown in poultry industry, mainly in Brazil, resulted in oilmeal exports dropping 64 per cent in April.

WHAT A FALL !

Dropping Shipments

(in tonnes)

Month	Soyabean	Rapemeal	Grountnut Meal	Rice Bran Ext.	Castor	Total	2008
Jan	521243	27680	-	5862	14800	569585	839392
Feb	375098	27558	10748	9120	21901	444425	763047
Mar	224639	83041	11300	8200	10820	338000	853675
April	100106	102187	-	12580	16944	231817	646592
Total	**1221086**	**240466**	**22048**	**35762**	**64465**	**1583287**	**3102706**

Besides these, some of the Asian countries suffered from crisis in the livestock industry, leading to lower consumption of soyameal and other oilmeals.

According to the Solvent Extractors Association of India, oilmeal exports in April dropped to 2.31 lakh tonnes against 6.64 lakh tonnes during the same period a year ago.

Increase in prices

A bright spot in the export scenario is the increase in prices of soyameal. “Due to failure of soyabean crop in South America, resulting in decline in world supplies by 15 million tonnes during the current season, production of soyameal has been affected. Therefore, prices of soya and other oilmeals have firmed up since January,” the association said.

Since January, soyameal prices have increased by over $100 a tonne, while other meals prices have also increased significantly.

In April, China, Vietnam, South Korea and Japan were the major buyers of Indian oilmeals. China brought over 58,000 tonnes of oilmeals, mainly rapeseed meal above 57,000 tonnes. Export to Vietnam was down to 61,882 tonnes against 3.13 lakh tonnes during the same period a year ago. Similar was the story with shipments to Japan, South Korea and Thailand.

Meanwhile, as part of its efforts to shore up oilmeal exports, the Association has decided to depute a 16-member trade delegating to South-East Asian countries from May 21. The team will visit Thailand, Cambodia, Vietnam, the Philippines and Indonesia.

(The Hindu Business Line, 7th May, 2009)

TRIPPED !

Global oil yields: Have we got it seriously wrong?

Denis J. Murphy

Up to now, most oilseed crop specially have assumed that one metric ton (MT) per hectare (1 MT/ha) was a pretty good ballpark figure for average oil yields from annual oilseed crops such as canola or sunflower. Of course the precise figure varies somewhat depending on the crop variety, climatic zone, and agronomy. of oil in the Canadian prairies, whereas high-input, autumn-sown canola/rapeseed varieties in milder European climates average something closer to 1.4 MT/ha. Soybean has lower seed oil content, but is still manages about 0.5-0.6 MT/ha. of oil in the Canadian prairies, whereas high-input, autumn-sown canola/rapeseed varieties in milder European climates average something closer to 1.4 MT/ha. Hence, the globally averaged oil yield from temperate crop is generally quoted at more or less 1 MT/ha. Thanks to improved varieties and agronomic practices, these estimated yield have increased slightly over recent decades but have not strayed too far from that magic figure of 1 MT/ha (see Table 1).

TABLE 1. Estimated oil yields from selected crops

Crop	Previous estimates, MT/h[a].	New estimates[b], MT/h
Canola	1.2	0.49
Sunflower	1.0	0.42
Groundnut (Peanut)	0.84	0.4
Soybean	0.56	0.36
Oil palm (includes kernel oil)	4.1	4.1
Maize (corn) ethanol	3.1	1.6

[a]MT/ha, metric tons per hectare.
[b]Johnston et al., 2009.

Over the last five years or so, these estimates of global vegetable oil yields have been used to calculate the expected efficiency of biofuel crops, especially in the biodiesel sector. Oil yields are the key to life cycle analysis calculations of the net carbon or energy gain (or loss) from producing fuels from crops, compared with conventional fossil-derived petroleum feedstocks. These sorts of anaslyses have recently caused concern in some quarters when it was claimed that bioethanol made from US Midwestern cornstarch might be even worse than gasoline in its net greenhouse gas emissions. But thanks to that oil yields figure of 1 MT/ha, most observers would agree that oilseed-derived biodiesel fuels have fairly robust enviormental credentials.

However, all those assumptions may need to be revised if the conclusion of a recent, carefully crafted survey of global energy crop yields are correct. The result were published in the journal Enviroment Reaserch Letters in January 2009 by a group led by Matt Johnston from the University of Wisconsin-madison (USA). There surprising conclusion is that for nearly all crops, we have got our oil yields figures seriously wrong. In most cases, they reckon that yields were overestimate by more than 150%. This means that our ballpark figure for oil yield from annual oilseed crops should be less than 0.5 MT/ ha, instead of 1 MT/ha.

And there was another sting in the tail of the Wisconsin analysis. It seems that whereas annual oilseed yields may have been vastly overestimated, those of oil palm are more or less correct at about 4.1 MT/ha (made up of 3.68 MT/ha palm oil plus 0.44 MT/ha kernel oil). This means that the oil yield of palm per hectare may be as much as ninefold

Mature oil palms.

higher than that of temperate oilseed crops. Palm oil production costs are also lower because the crop is perennial, so it does not require annual sowing, and it is normally grown in lower wage regions of world.

Moreover, whereas temperate oilseed crops may already be close to their maximum biological potential oil yield, oil palm breeders are developing varieties that yield in the region of 9–16 MT/ha, which is a massive 20- to 35- fold higher than canola or sunflower. Perhaps now may be a good time to consider investing in the burgeoning oil palm industry in South America, where new high- yielding plantations are rapidly coming on-stream in countries such as Colombia and Ecuador. This is already happening in Africa, where China has reportedly secured rights to grow palm oil on 2.8 million ha in Congo and is now negotiating for a further 2 million ha in Zambia. The amount of oil that could be produced on 4.8 million palm-planted ha would require about 55 million ha of soybean, almost double the area of the entire US soybean crop (estimated at 31 million ha in 2009).

If these surprising results from the Wisconsin study are confirmed, they could fundamentally challenge our assumptions about the environmental case for biofuels as a major element in future strategies for sustainable energy provision. They could also affect sentiment about the wisdom of using food or feed crops as bioenergy Feedstocks. This is especially topical at a time when the United nations is dramatically increasing its estimates of the numbers of people suffering acute food shortages, and as the economic downturn and food price hikes disproportionately affect the poor in developing countries. Commenting on the significance of their study, Matt Johnston said :

" Our evaluation of crop yields shows the importance of place-and crop-specific data to inform decision- making on agricultural biofuels. Additional work would be required to evaluate the environmental benefits of specific biofuels produced at specific places, but it is clear that the life-cycle costs are highly dependent on where and how crops are produced."

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CONFLICTING

Highlights from Milan isoflavone symposium

Mark Messina

Isoflavones are a group of diphenolic compounds with a limited distribution in nature. Among commonly consumed foods, they are found in nutritionally relevant amounts primarily only in the soybean. It is largely for this reason that the health effects of soy foods have been the focus of so much attention. Proposed health benefits linked to isoflavone intake include protection against breast and prostate cancer, osteoporosis, and heart disease, as well as the alleviation of menopause-related hot flashes.

The three isoflavones in soybeans are present primarily as the glycosides genistin, daidzin, and glycitin to which can be attached acetic and malonic acids. Most interest in isoflavones stems from their estrogen-like effects, but these same properties have led to concerns that isoflavone and soy food intake may have untoward consequences, especially in specific subpopulations.

For example, despite its long history of use, questions about the safety of soy infant formula have been raised. This issue was formally evaluated by the US National Institutes of Environmental Health Sciences in 2006, but a second evaluation is planned for later this year. Unarguably, however, the concern that has led to most consternation and confusion among both health professionals and the public is the possibility that isoflavone-containing products stimulate the growth of estrogen-sensitive tumors. In fact, this concern was one of several that led to request by the BfR (Federal Institute for Risk Assessment in Germany) for the European Food Safety Authority (EFSA) to evaluate the safety of dietary isoflavone supplements and isoflavone-rich foods including soy infant formula. A subcommittee of EFSA is expected to submit a report to the executive director by the end of 2009. A separate EFSA working group is also evaluating the efficacy of isoflavones for alleviating hot flashes.

To present the results of recently conducted studies most relevant to understanding the health effects of isoflavones, the Council for Responsible Nutrition (CRN; www.crnusa.org) convened a two-day symposium of internationally recognized experts to discuss the safety and efficacy of isoflavones for postmenopausal women. CRN is a trade association based is Washington, DC, USA. The meeting, held May 13-14 in Milan, Italy, was formally opened by Antonello Sannia, International Academy of Phytotherapy (Dolo Venice, Italy), who presented the objectives of the meeting. Following him was Miriam Jacobs (EFSA), who discussed the agency's mandate to evaluate the safety of isoflavones. Highlights of selected presentations are summarized below.

BREAST CANCER

The session on breast cancer began with Mark Messina, Loma Linda University (Califorina, USA), reviewing the primary evidence on which concern that isoflavones may pose a risk to breast cancer patients and high-risk women is based: Namely, that in athymic overiectomized mice implanted with MCF-7 cells (an following removal of the estrogen pellet that is needed to stimulate tumor growth (generally removal occurs when the cross-sectional area of tumor is between 30 and 40 mm^2), there is an initial period of tumor regression in all mice. In mice consuming diets containing genistein (the glycone form), through tumor regression is followed by eventual tumor regrowth. Messina discussed the strengths and weaknesses of this animal model, which has been used extensively in cancer research. One of the more controversial finding arising from this model is that processing influences tumor stimulation. That is, despite containing similar amounts of genistein, more highly processed soy products lead to greater tumor stimulation. The explanation for this observation is that processing leads to higher peak plasma free (unconjugated) genistein levels.

Following Messina, Kenneth D.R. Setchell, Cincinnati Children's Hospital Medical Center (Ohio, USA), presented an extensive review of isoflavone absorption and metabolism. He began by noting that proportion of isoflavone aglycones in soy foods

and supplements is very low (1-2%), unless the food is subjected to fermentation, as in the case of tempeh, natto, and miso, because the intestine and liver are very efficient at glucuronidating isoflavones once absorbed. Next, Setchell presented new date from his research group showing that in humans, processing of genistin-containing soy products does not affect peak circulating free (unconjugated) genistein levels as it does in athymic overiectomized mice. More specifically, peak unconjugated genistein levels response to the consumption of soynuts (minimally processed), soymilk, and isolated genistin (highly processed) were similar.

To explore the relationship between soy and breast cancer risk, several clinical studies have examined the impact of isoflavone-containing products on mammographic breast tissue density and breast cell proliferation in biopsy samples using the immunohis-to chemical marker Ki67 (a nuclear protein expressed by cells in all active phases of the cycle but not in quiescent or resting cells). Gunnar Soderqvist, Karolinska Institute (Stockholm, Sweden), discussed the value of these markers and noted that conventional hormone therapy (estrogen plus progestin) increases both density and proliferation and breast cancer risk. In contrast to the effects of conventional hormone therapy, isoflavones have on these two breast cancer markers.

Jeffrey Tice, University of California (San Francisco, USA), reviewed the results from the eight studies (half involving premen-opausal women; half involving post-) showing that isoflavones do not affect breast tissue density. The trials included nearly 1,700 subjects, their duration ranged from six months to three years, and the isoflavone dose from 40 to 20 mg/d.

Next, Eva Lundstrom, Karolinska University Hospital, discussed the four studies that took breast biopsies and assessed cell proliferation before and after isoflavone exposure; two involved breast cancer patients, one healthy subjects, and one women undergoing breast biopsy or definitive surgery for breast cancer. Daily isoflavone intake in these trials ranged from 36 to >100 mg/d and study duration from two weeks to one year.

The final presentation in this session was by Xiao Ou Shu, Vanderbilt University (Nashville, Tennessee, USA), who reviewed the three epidemiological studies that have evaluated the impact of soy food intake on the prognosis of breast cancer patients. A report from the Shanghai Breast Cancer Study (SBCS), which was published in 2005, showed that neither soy protein nor isoflavone intake prior to breast cancer diagnosis was related to breast cancer prognosis among 1,459 breast cancer patients, approximate two –third of whom were ER+. However, preliminary results from an ongoing cohort study of 5,043 breast cancer patients who are also part of the SBCS, and enrolled approximately six months after cancer diagnosis, show that soy intake, measured either as soy protein or soy isoflavone intake, was associated with favorable outcomes. Further, the benefit of soy food intake, on survival was more intake did not impact the efficacy of tamoxifen. The third study that was reviewed, a recently published report from a cohort of 1,954 breast cancer survivors in the United States who were prospectively followed for 6.31 years, also found evidence to suggest soy food intake after diagnosis improved prognosis and that soy foods did not interfere with tamoxifen.

THYROID FUNCTION

The second day of the symposium began with an examination of the impact of isoflavone exposure on thyroid function. In vitro and in vivo, in rats genistein inactivates thyroid peroxidase (the key enzyme in thyroid hormone synthesis), although despite the inactivation, thyroid function remains normal. In his review of this topic, Francesco Squadrito, University of Messina (Italy), noted that 20 clinical studies, some of which have been conducted for three years in duration, have shown that in euthyroid individuals neither soy foods nor isoflavone supplement affect thyroid function. In fact, unpublished three-years data presented by Squadrito show that genistein (54mg/d) not only has no effect on thyroid hormones but also does not affect the expression of T3 nuclear receptors and retinoic acid nuclear receptors (RAR, RXR) in human peripheral blood mononuclear cells, which are sensitive markers of thyroidal influences. Although it remains to be definitively established whether isoflavones affect thyroid function in subclinical hypothyroid individuals, or in those whose iodine intake is inadequate, there are at least preliminary data indicating this is not the case for the former.

ENDOMETRIAL CANCER

Estrogen-only therapy stimulates endometrial thickness, endometrial tissue proliferation, and increases endometrial cancer risk, so it is not surprising that the impact of isoflavone exposure on endometrial tissue and cancer risk has been studied by numerous investigators. Those identified reported that isoflavone supplements (from soy and red clover) or isoflavone-rich soy foods or soy protein affected endometrial thickness. However, a five-year study found that, in comparison with the placebo group, isoflavone supplements slightly increased risk of developing simple hyperplasia among postmenopausal Italian women. These results should be interpreted cautiously, however, because three were a number of study limitations. For example, compliance was not assessed, no information on endometrial thickness and bleeding patterns was provided, and specific details about the isoflavone content of the intervention products were lacking. In addition, it is not clear that women with inaccessible endometrial samples (~25%) at baseline were excluded for evaluation at future time points; therefore, it is possible some hyperplasia was present at study onset.

Furthermore, although not a design weakness, there is some evidence that the absence of hyperplasia in the placebo group is atypical. In the Postmenopausal Estrogen and Progestin Interventions (PEPT) Trial, over just a three-year period, 2.4% of the placebo group developed endometrial tissue abnormalities (cancer or hyperplasia). If this rate had occurred in the placebo group in the above-mentioned Italian study, almost certainly the differences between group would not have been statistically significant.

Finally, although only limited epidemiologic research has been conducted, these data suggest that isoflavone exposure from soy foods is associated with a reduced risk of endometrial cancer. Given all of the date, Messina concluded that the evidence dose not allow effects on endometrial cancer risk to used as a basis for recommending for or against the use of soy foods or isoflavone supplement.

HOT FLASHES

Hot flashes are a classic symptom of menopause; in Europe and North America about 70% of women are affected by them. Maria Andrikoula (University of Ioannina Medical School, Greece) noted, though, that this is the case for only 5 to 18% of Japanese and Southeast Asian postmenopausal women. In 1992, Adlercreutz and colleagues suggested that the low prevalence of hot flashes reported by Japanese menopausal women might be at least partially due to their high consumption of soy foods. More than 50 hot flash trials evaluating the efficacy of isoflavone- containing products

have been conducted; however; the results overall are quite mixed. Several explanations for the mixed data have been proposed. These include the variation in baseline hot flash frequency, interindividual differences in isoflavone metabolism, and the differing genistein content of the intervention products.

In an attempt to provide some clarity about the effects of isoflavone supplements on the alleviation of hot flashes, Mindy Kurzer, University of Minnesota (Minneapolis-St. Paul, USA), presented the results of an ongoing systematic review and meta-analysis of the literature (although only studies evaluating the effects of isoflavone supplement derived from soybeans were considered). For the systematic review, 16 studies met the inclusion criteria; of those, 12 reported that isoflavone significantly alleviated hot flash frequency and/or severity. Efficacy was similar for severity and frequency.

For the meta-analysis, 10 trials met the inclusion criteria; the average reduction in frequency and severity beyond the placebo effect was 16 and 20%, respectively. Sub-analysis of the data indicated that supplement providing at less than this amount. Kurzer concluded that these preliminary results show that quality of life for women suffering from frequent hot flashes when considering the overall improvement (including the placebo response) is approximately 50%. Addressing this points, Gordana M. Prelevic, Royal Free Hospital (London, England), noted that many women are seeking natural alternatives to estrogen for the alleviation of hot flashes and that according to a recent survey among those who are, the vast majority would be quite pleased with a treatment that provides at least a 50% reduction in symptom frequency.

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The final presentation of the symposium was by Clemens B. Tempfer, University of Vienna School of Medicine (Austria), who reported on the results of recently accepted-for-publication meta-analysis that used a fixed-effects model to evaluate the side effects of phytoestrogen treatment compared with placebo or no treatment in randomized controlled trials. In total, 92 randomized controlled trials with 9,629 participants were identified. The only side effect that differed in frequency between the active and control groups was a higher rate of gastrointestinal disturbances among the former. Based on the available evidence, it was concluded that phytoestrogen supplements have a safe side effect profile, with moderately elevated rates of gastrointestinal side effects.

NOT SO SOFT !

Cotton International

World Cotton International

World cotton production declined in both 2007/08 (by 2%) and 2008/09 (by 10%) to 23.7 million tons, the smallest production since 2003/2004. These two consecutive declines were caused principally by decreased in cotton area, as cotton prices have become less attractive relative to competing crop prices and production costs have increased. World cotton area decreased by 5% in 2007/08 and 6% in 2008/09, to 31 million hectares. The world yield climbed to a record of 795 kg/ha in 2007/08, but was estimated down to 763 kg/ha in 2008/09 due mainly to unfavourable weather.

In 2009/10, world cotton production is expected to remain stable at 23.6 million tons. Decreasing cotton returns, more attractive prices for competition crops, and expected difficulties in financing inputs are encouraging farmers to plant less cotton. World cotton area is forecast down by 3% to 30.2 million hectares in 2009/10. The average yield is projected at 781 kg/ha, slightly higher than in 2008/09, assuming more favourable weather.

In 2007/08, production declined significantly in the United States, Pakistan, Turkey, Burkina Faso and Australia, but reached new records in China (P.R), India and Brazil. In 2008/09, the decline in world production was driven by a fall of more than 1.3 milion tons in the United States. production was also estimated lower in China(P.R), India, Uzbekistan, Brazil & Turkey, but slightly larger in Pakistan. U.S production has declined for three consecutive seasons and fell to 2.8 million tons in 2008/09, down by nearly half from the record in 2005/06. Production in Turkey has declined each season since 2004/05 and fell to 450,000 tons in 2008/09, or just half its level of 2004/05, In 2009/10, production is expected to decline in China (P.R) and Turkey, but to increase in india and the United States.`

World cotton mill use was estimated stable in 2007/08, at 26.3 miliion tons, but fell in 2008/09 for the first time in a decade, by an estimated 13% (the largest decline since World War Two) to 22.9 million tons. World cotton mill use is forcast slightly higher at 23.1 miliion tons in 2009/10. This projection is based on the possibility of a slight recovery in world economic growth in 2010. Cotton mill use is expected to partially recover in China (P.R), India and Pakistan, but to continue to decline in many smaller consuming countries that had already been experiencing long-term declines in mill use before the global economic crisis started.

World ending stocks declined slightly in 2007/08, to 12.5 miliion tons, but they are projected to reach 13.3 million tons by the end of 2008/09, or 58% of 2008/09 world mill use. World stocks will remain high relative to demand in 2009/10.

World Cotton trade was estimated at 8.3 million tons in 2007/08.

However, as a result of the decline in demand from importing countries, world cotton trade is projected sharply down to 6.1 million tons in 2008/09; this would be the smallest volume traded since 2000/01. Many countries have seen their stocks increase in 2008/09, which will provide significant supplies in 2009/10. World cotton imports are forecast to rebound by 11% in 2009/10 to 6.7 million tons, helped by the expected small recovery in mill in china (P.R.) Chinese imports are expected to increase by Turkey and Pakistan are also expected to increase. Export by the United States are expected to decline to 2.4 million tons (-9%), whereas export by India are projected to more than double to 1.2 million tons.

Three crisis affecting the world cotton market

Since 2007/08, the world cotton market has been affected by three successive events: a global commodity price crisis, which resulted in higher agriculture costs and reduced world cotton area; a crisis in the cotton futures market, which hurt cotton trade mechanisms; and a global financial and economic crisis, which has had multiple effects on cotton mill use, trade and production.

The Global Commodity price crisis

Prices of most commodities increased significantly between 2003 and the first half of 2008. This increase accelerated considerably starting in 2007. crude oil prices increased from USD 29 per barrel

in 2003 (annual average) to USD 29 per barrel in 2003 (annual average) to USD 133 per barrel in July 2008. The increase in energy prices triggered an escalation in fertilizer prices starting in mid-2007 and ending in the middle of 2008. The World bank fertilizer price index increased by factor of ten between 2003 and July 2008, and the rise in energy and fertilizer prices generated an increase in agricultural production costs. In addition, the level of stocks relative to the use of major food crops had been declining for some time, making their prices more sensitive to shocks. Demand for some food crops was boosted by goverment biofuel subsidies and mandates. weather – related crop failure, speculation and some goverment policy decisions contributed to higher food crop prices during 2007 and the first half of 2008, and prices of many food crops remain higher than long run averages yet.

Fertilizers account on average for around 20% of overall cotton production costs, but there are large regional variations, depending on soils, weather, crop rotations and management, and the intensity of fertilizer use. Cotton is generally more expensive to produce than soybeans, maize and wheat.

Cotton requires larger quantities of fertilizer than soybeans and wheat, and larger amounts of pesticides and fuel (if machine labor is used) than soybeans, maize and wheat. As a result, cotton production costs have been relatively more affected than these other crops by the crude oil and fertilizer price increases. Prices of cotton's main alternative crops (grains and oilseeds in particular) have become more attractive than cotton prices over the last few years. This trend accelerated during 2007 and in the first half of 2008. As a result, in the countries where shifts in acreage among crops were possible, many farmers opted out of cotton production to turn towards production of alternative crops. Higher cotton production costs and more attractive prices for alternative crops were the main factors explaining the decline in world cotton area in both 2007/08 and 2008/09.

The cotton futures market crisis

Futures prices were extremely volatile during March 2008, mostly because of increased speculative activity at the Intercontinental Exchange (ICE) and volatility in prices of competing commodities. The Cotton #2 contract for May 2008 delivery fluctuated between 69 cents per pound and 90 cents per pound during March 2008. The Cotlook A Index, an indicator of world cotton prices, demonstrated similar volatility, reaching a high of 90 cents per pound on March 3, 2008 and falling to a low of 74 cents per pound on March 20, 2008.

The short-lived spike in futures prices caused a liquidity crisis. As a result, some merchants hedging their positions at the exchange were faced with huge margin calls and were forced to liquidate their positions at a loss. Many merchants could not recover from these losses in the physical market. Some were driven into bankruptcy and other decided to go out of the cotton business. Other consequences of the March 2008 events are a decrease in banks' trust in the cotton futures market and calls, a reduced trust of cotton market participants in the mechanisms of the futures market, and difficulties for merchants to purchase in advance and at fixed prices large quantities of cotton (as was commonly done before the futures market crisis).

The global financial and economic risis

The world economy expanded robustly in 2007 marked the beginning of a period of global economic deceleration and crisis in the functioning of the housing, financial and commodity markets. According to the January 2009 projections of the International Monetary Fund (IMF), global economic growth decelerated from 5.2% in 2007 to 3.4% in 2008. On March 31, 2009, the First Deputy Managing Director of the IMF announced that the Fund is expecting global economic growth to contract by 0.5% to 1.5% in 2009 forecast a contraction of 1.7% in global economic growth in 2009 and a recovery to 2.3% in 2010. The global economic outlook for 2010 remains very uncertain.

While the two crises mentioned earlier primarily affected cotton production and trade, the global economic crisis is influencing mainly textile purchases by end-use consumers and therefore cotton consumption. In addition, tightening credit conditions for textile mills are slowing their purchases of raw materials, including cotton. In some countries (for example in Europe and in United States), the global economic crisis is accelerating a de-

cline in cotton mill use that started many years ago, due to other factors. In other countries such as China (P.R.) and India, the two largest industrial users of cotton, cotton mill use is contracting in 2008/09 for the first time in many years. China (P.R.) accounts for around 40% of world cotton industrial consumption. Mill use in China (P.R.) rose by an average annual rate of nearly 11% between 1998/99 and 2007/08.

However, 2008/09 mill use in China (P.R.) is projected at 9.0 million tons, a decline of 17% from the 2007/08 level. Likewise, Indian cotton use rose at an average rate of about 7% over the last five seasons, but a decline of 6% to 3.8 million tons is expected in 2008/09.

The current decline in cotton mill use in these two countries was unexpected in early 2008. World cotton mill use is expected to fall by 13% in 2008/09 to 22.9 million tons. This would be the strongest decline recorded since World War Two. The global economic crisis, through its impact on world cotton mill use, is also affecting cotton trade, stock and production. The lower demand for cotton is causing a 27% drop in imports this season, to 6.1 million tons.

The ratio of world cotton imports to world mill use, which averaged 31% in the last decade, is falling to 26%, reflecting tighter credit conditions, tighter operating margins for textile mills and caution on the part of textile mill operators. Chinese imports, which represented 30% of global imports last season, are expected to drop by 42% in 2008/09 to 1.5 million tons.

Exporters are being forced to carry larger stocks than desired. Exports are projected down by 13% in the United States to 2.6 million tons, by 70% in India to 450,000 tons, and by 38% in Uzbekistan to 550,000 tons.

Global cotton stocks are expected to increase by 6% in 2008/09 to 13.3 million tons and the global stocks-to-use ratio is expected to increase from 48% to 58%, the highest since 1998/99. Finally, the tightening of credit conditions worldwide will also affect world cotton production in 2009/10, as it is making it more difficult for cotton producers to finance their inputs.

Impacts of the Crises on the African Cotton Sector Africa accounted for 5% of world cotton production, 2% of world cotton mill use and 13% of world cotton trade in 2007/08 (almost all African cotton is exported). These relatively small market shares imply that the African cotton market has a minor effect on the world cotton price and is therefore dependent on what happens in the rest of the world. According to the IMF projections published in January 2009, economic growth in Africa could slow from 5.2% in 2008 to 3.4% in 2009.

African cotton production declined each season from a record of 2.0 millions tons in 2004/05 to 1.2 millions tons in 2008/09, due mainly to decreases in area, but also partly to declining average yields. Cotton exports have also declined over the same period, form 1.5 millions tons to 0.9 millions tons. The share of African exports in the world total declined from 19% to 14% over this period. The significant decreases in African cotton production over the last few years was driven by a fall in production in the African Franc Zone and North Africa. Production in East and Southern Africa dropped from 2004/05 to 2006/07 but recovered in the following two seasons.

There are no direct government payments to cotton producers in Africa. Cotton Production on the continent is therefore responsive to variations in world cotton prices. Lower international cotton prices, aggravated in many countries by an unfavorable exchange rate, had already weakened the African cotton industry in the seasons preceeding the crises.

While the commodity price crisis has not had a significant direct impact on African cotton area, due to the lack of alternative crops in many regions, the rise in agricultural production costs resulting in declines in cotton area and/or yields (when farmers applied lower quantities of fertilizer than usual.)

The crisis in the cotton futures market has not had a significant direct impact on the African cotton industry, as most African cotton companies make little use of hedging instruments. However, the cotton futures market crisis has affected the ability of international traders to buy large quantities of African cotton early in the season, at fixed prices. This will likely harm the finances of cotton companies and ginners.

Finally, African cotton exports have been affected (as have exports from other regions) by the decline in demand from consuming countries in 2008/09. Also, the tightening of credit conditions due to the global economic crisis will make it difficult to finance 2009/10 production inputs, in continent that is already facing high interest rates.

African cotton production is projected to continue to decline by 2% in 2009/10, driven by expected further reduction in cotton area in the African Franc Zone. However, production in Egypt is projected to increase. Exports from African countries are expected to increase in 2009/10 to 980,000 tons.

In Summary, the three global crises affecting the cotton market have worsened an already difficult situation for the African cotton industry. This situation could be alleviated by a weakening of local currencies vs. the US dollar (which would soften the decline in cotton prices at the local level) and/or an increase in cotton productivity. The ICAC Cotton Price Forecast for 2009/10. The season average Cotlook A Index jumped by 23% to 73 cents per pound during 2007/08. Factors other than fundamental changes in cotton supply and use contributed to the significant increase in the level and volatility of cotton prices that season. Such factors perhaps included the weakening of the US dollar, soaring prices of commodity futures, and increased participation of institutions and individuals not involved in physical cotton trade in the cotton futures market. Taking into account the average Cotlook A Index between August 2008 and the first week of April 2009, and expected levels of cotton supply and use, the ICAC Price Model 2007 projects the season-average Cotlook A Index at 59 cents per pound in 2008/09, down by 19% form last season. The 95% confidence interval ranges from 56 to 62 cents per pound.

Based on the price forecast for 2008/09 and expected changes in supply and use, the ICAC Price Model 2007 forecasts a 2009/10 season-average Cotlook A Index of 56 cents per pound, with a 95% confidence interval ranging from 44 to 62 cents per pound. However, caution must be exercised since all commodity markets are subject to great uncertainty, and the forecast bears substantial downside risks. Conditions in Place for Longer Term Growth Despite the current difficulties, cotton Terms Growth Despite the current difficulties, cotton remains a viable commodity of wealth, employment and growth in the long run. With a rebound in world economic growth expected to begin in 2010 and improve in 2011, demand for cotton will improve in 2011, demand for cotton will strengthen again. Technology changes in cotton production are contributing to both higher yields are reduced environmental impacts, creating the conditions for long growth in the cotton sector.

Further, consumers the world over prefer natural, renewable and comfortable cotton in apparel and home furnishings. World consumption of cotton reached a record of more than 26 million tons in 2007, and a return to that level is likely within a few years after the economic recession has run its course.

(Tecoya Trend 22nd & 23rd June, 2009).

Source : AICOSCA, June 2009, P. 26-29.

HOPEFUL

Genetic resource center for jatropha

SG Biofuels, a sustainable plant oil company based in San Diego, California, USA, opened its Jatropha Genetic Resource Center (GRC) at the end of April. Its purpose is to accelerate profitable, large-scale production of jatropha as a low-cost , sustainable source of feedstock for biofuel.

Jatropha curcas is a shrub native to Central American that well on marginal land (*inform* 19:834-836, 2008). Its seeds, which are inedible, contain high amounts of oil that can be used for biodiesel and as a feedstock substitute for the petrochemical and jet fuel industries.

With research sites in San Diego and several Latin American countries, SG Bio-fuels and its GRC claim to possess the largest, most genetically diverse library of jatropha genetic material in the world. The GRC will aid the company's efforts to implement genetic improvements to enhance yield, improve agronomic practices, and broaden the effective growing range of this subtropical crop.

The company proposes that oil yields of 200-300 gallons (800-1,000 liters) of extractable oil per acre annually are realistic today, and Kirk Haney, president and chief executive officer for SG Biofuels, said in a company press release, "[W]e are confident we can double the yield of jatropha within the few next years."

Source : Inform, June 2009, P 360-361.

COOL

Cold-tolerant Jatropha

S. G. Biofluels (Encinitas, California, USA) announced in June that it is has identified several strains of cold-tolerant jatropha capable of thriving in climates previously thought to be outside of the crop's preferred subtropical habitat. Utilizing the strains, the company has initiated a breeding program to develop jatropha as an oil-producing crop in colder climates of the United States. After testing and cross breeding. SG Biofuels could open the US Gulf Coast for Jatropha cultivation. The region has been considered amenable for jatropha, because frosts occur only occasionally in the area.

These cold-toleranant strains are included amoung thousands of variants of Jatropha curas the firm has collected from a range of climates and geographies around the world as part of its Genetic Resources Center, the company's collection of Jatropha genetic material (see inform 20:360, 2009).

Source : Inform, Aug. 2009, P 514.

(A THESIS)

Utilisation of Cottonseed

Cottonseed

It is well known that as much as 60-70% of seed is available from seed cotton during ginning. As per the estimate the production of cottonseeds in India during 2008-2009 is 107 lakh tonnes as against 290 lakh bales (170 kg) of cotton. The cottonseed despite being rich in edible oil and protein, it has not received as much attention as it deserves. The seeds are stored in open and there could be chances of infection by fungi elaborating aflatoxins. Such seeds become unfit for feeding to cattle and even the meal can not be exported. Efforts have to be made to utilize cottonseed more scientifically to realise good returns. The lint and seed yield in different species of cotton are given in Table 1. There are cases that cottonseeds are also being imported and exported.

Table : Lint and Speed Yield in Different Species

Species	Lint Yield	Seed Yield
G. arboreum	34	66
G. herbaceum	38	62
G. hirsutum	36	64
G. barbadense	29	71

The seeds obtained during ginning is considered as a by-product. The seeds when scientifically processed yield four individual components (Table 2).

Table 2: Cottonseed By-products

Linters	Short fibres still clinging to the seed after ginning
Hulls	A tough protective covering of the kernel
Oil	Extracted from kernel
Meal	Residue after extraction of oil

Cotton Linters

The linters are fuzzy short fibres which form a dense mat adhering to the surfaces of cotton seed. They are removed from seed surface by delinting machines. Based on delinting process adopted, linters are classified as first cut, second cut and mill run. *G. hirsutum* varieties have the highest linter content (about 10.5%). Desi varieties have an average of about 4.3% - 5.9%. As much as 10,000 tonnes of linters in organised sector are available in our country each year. Linters are used for the manufacture of cellulose products like cellulose acetate, carboxy methly cellulose, viscose rayon, microcrystalline cellulose, cellulose nitrate, etc., preparation of specialty grade paper, absorbent cotton, etc. The data on the export of cotton linters is given in Table 3. Cotton linters are aven being imported.

Table 3: Export of Cotton Linters

Year*	Quantity (Tonnes)	Value (Lakh Rupees)
2006-2007**	6804	1072
2005-2006	16654	2333
2004-2005	5020	766
2003-2004	12392	1663
2002-2003*	Nil	-
2000-2001	8125	1283
1999-2000	2003	225
1998-1999	2291	243
1997-1998	7159	848
1996-1997	2131	323

* Export ban was invogue ** From April 06 to Dec. 06

Preparation of Pulp and Paper from Cotton Linters

The linter sample was mechanically cleaned using shirley trash separator. Cleaned linter sample of alkali (2%, 4% and 6%) in a rotary bomb digester at 160°C for 2 h. The kiered sample were washed thoroughly and then converted into pulp by beating in a valley beater to desired freeness. Pulp samples were bleached in plastic containers using hypochlorite at 40°C for 2 h. Standards paper sheets were prepared from all the pulps and evaluated for various strength properties. The test results indicated that the quality of paper was quite satisfactory. There was a gradual improvement in properties of paper with increase in the concentration of alkali from 2% to 6% while the yield levels showed a declining trends. The results are given in Table 4.

Table 4: Properties of Paper Prepared from Linters

Properties	2% NaOH	4% NaOH	6% NaOH
Grammage	60 ± 1	60 ± 1	60 ± 1
Brust Factor	19	24	29
Tear Factor	107	128	143
breaking length (m)	2997	3216	3849
Number of Double Folds	38	46	78

High Grade Pulp from Cotton Linters

High grade pulp from cotton linters was prepared by digesting mechanicall cleaned cotton linters in rotary digester with 7.5% NaOH at 165°C for a period of 3.5 h. (which included about 1.5 h to reach the maximum temprerature). The material to liquor ratio was 1:6. The cooked material was washed thoroughly and then bleached using sodium chlorite. The bleached pulp was washed thoroughly and then air dried. The pulp was characterised by carrying out standard test methods. The profitability of high grade pulp from linters is given below.

Costing of pulp from linters (per tonne)

	Rs.
Raw material @ Rs.25/kg	25,000.00
Chemical (NaOH)	24.00
Water	105.00
Bleaching chemical (Hypo) and peroxide	600.00
Electricity and Labour	1200.00
Overheads	1200.00
Expected yield of pulp (80%)	800 kg
Expected sale price (@Rs. 60/kg)	48,000
Running cost	23,345
Depreciation @ 10%	340
Net profit (per day) during value addition	24,315
Total profit per day	**44,315**

Uses of high Grade Pulp from Linters

The high grade pulp is a good raw material for preparing viscose grade fibres, cellulose acetate, cellulose.

Cotton Linter-dust

During cleaning of cotton linters, about 20% of dust is generated which contains high percentage of lignin (from seed coat fragments) apart from cellulose, pectins and ash. It has been found out that this material can be fed directly into cow-dung based biogas plants to obtain better methane production. Even batch digestion of this material, it is possible to produce about 600 litres of biogas in 45 days retention time per kg of material. The methane percentage would be around 60%.

Cottonseed hulls

Bioenriched Cattle Feed

Cottonseed hill is a conventional feed for cattle and is a by-product of seed crushing industry. Cottonseed hulls are available in abundance and are rich in cellulose content but poor in digestibility. The presence of lignocellulosic bonds make the material difficult to digest by ruminants. It is well known that microorganisms attack lignocellulosic bonds of these materials resulting in improved digestibility of the materials. The digestibility of cottonseed hulls could be improved by subjecting to an inexpensive anaerobic treatment with mixed microbial consortium for 7 days at room temperature.

The anaerobically treated cottonseed hulls were analysed for various chemical constituents. The result given in table 5 indicates that the percentage of crude protein has increased to 7.5 from an initial value of 4.6. The digestibility percentage (IVRD) has increased to 60% from an inital value of 50% (Table 5).

Feeding trials were undertaken on crossbred lactating cows at NDRI, karnal to ascertain the efficacy of the treatment.

Table 5: Chemical Constituents of Cotton Seed Hulls

Chemical Constituents (%)		Cottonseed hulls Untreated	Treated
Dry matter		89.2	90.3
Nitrogen		0.7	1.2
Protein		4.6	7.5
Crude Fibre		57.6	53.2
Ash		2.2	3.0
Ether Extractives		1.8	1.1
Holo Cellulose		62.1	56.5
	a	40.4	9.6
Cellulose	b	12.1	13.4
	y	9.6	7.6
Reducing Sugar		0.3	0.1
Total Sugar		1.9	2.2
Digestibility		50.0	60.0
NDF		96.3	91.6
ADF		75.1	73.4
Lignin		20.9	23.4
Acid insoluble ash		1.2	1.4
NFE		23.0	25.5

NDF: Neutral Detergent Fibre ADF: Acid Detergent Fibre NFE: Nitrogen Free Extractives.

Animals preferred the fermented products over untreated ones as indicated by the total voluntary intake in lactating crossbred cattle under different dietary treatments.

Digestible nutrient intake and their digestibility coefficients showed a significant difference between control and treated groups.

There was no significant increase in the milk yield in the case of cottonseed hulls. However, animals were healthy indicating that cottonseed hulls nutritive value is on par with other conventional roughages despite a slightly higher feed intake in the case of treated hulls.

Non-conventional lignocellulosic materials can be made to useful fermented products by appropriate pretreatments. They can definitely serve as filter in a blend rather than wholesome feed. They can definitely act as acid absorbers in the rumen system and helps in slow release during metabolism. The load on alkaline saliva production to neutralise the acids produced during lignocellulose digestion will be reduced.

Scale-up trials are possible to enrich lignocellulosic materials in clusters around dairy farm by installing specific size digesters to supply fermented products without drying. This helps in better intake and digestibility, as it is well known that drying impairs both. Nitrogen loss will be prevented by feeding fermented products directly.

There is less loss of total organic matter (5% to 10%) during anaerobic treatment and hence a better treatment over the methods known so far where the loss has been upto 40%.

The method adopted being solid state fermentation, there is no generation of any effluents and the enriched material can be directly fed to cattle by mixing with concentrates.

Cottonseed Cake

Presently, in India, whole seeds are crushed and oil is extracted in which case the oil recovery is only 11-12%. The cake thus obtained is fed to cattle. The crude protein in the cake is about 25-27%. When kernels are used for extraction of oil, the recovery of oil is much better and cake fetches a better price due to high protein and good colour. Yellowish green colour is preferred. The protein in this cake is about 40%.

Cotton Meal

Cottonseed meal is a product of oil extraction. Solvent extraction meal has about 50% protein. A method has been standardised to prepare peptone (Protein hydrolysates) from cotton seed meal, which has various microbiological applications. Cottonseed meal is a good source of protein. Hydrolysis conditions for preparation of protein hydrolysate from cottonseed meal by two proteolytic enzymes, pancreatin and papain were standardised. It was observed that good quality peptone with desired degree of hydrolysis i.e. 28% was achieved when alkali (0.06%) pretreated cottonseed meal was hydrolysed with proteolytic enzymes namely pancreatin and papain in combination. The results are given in Table 6.The quality of the product was found to be better after 18 h incubation.

Table 6: Characteristic of Peptone at Different Stages of Hydrolysis

NaOH Pretreatment (%)	Enzymes	time of incubation (h) (%)	Total Nitrogen (%)	Amino Nitrogen (%)	Degree of hydrolysis(%)	Peptide Chain Length
0.06	Pancreatin + papain	18	09.7	2.8	28.9	3.5
0.06	Pancreatin + Papain	24	11.3	2.9	25.7	3.9

The peptone was found to induce cellulase and amylase significantly as compared to the commerical product when *Penicillium funiculosum* and *Bacillus subtilis* were grown in the respective media. The results are given in Table 7.

Table 7: Production of Enzymes on Cottonseed Meal (CSM) Peptones

	Commercial Product	CSM Peptones
Cellulase (Filter Paper Activity)	1320	180
Amylase	20	81

One tonne of cottonseed when directly sold will fetch about Rs. 10,000/tonne. When whole seeds are crushed for oil, about 12%maximum oil recovery is possible.

Table 8:Whole Cottonseed Crushing

Rs./tonne

Whole seed	11,000
Oil (12%)	5,640
Cake (80%)	8,000
Total	13,640
Cost of Production	600
Net Profit	2,040

Table 8 shows that it is possible to realize a net profit of Rs. 2,040/- per tonne. But about 8% oil lost since it remains in the cake i.e. about Rs. 3,760 per tonne is lost. The high percentage of oil in the cake when fed to cattle is not going to be used by the animals and hence this has to be discouraged.

The same material when scientifically processed yields four useful by-products which can fetch a net profit of about Rs. 4850/- i.e. an additional gain of Rs. 1,810/- from same one tonne material. Further, the by-products obtained will serve as raw materials for other industries Table 9.

Table 9 : Prices of Cottonseed By-products

(Rs./Tonne)

Whole Seed	11,000
Linters (5% recovery)	1,250
Hulls(35% recovery)	2,450
Oil* (20% recovery)	9,400
Cake (40% recovery)	4,000
Total	17,100
Cost of production	1,250
Net Profit	15,850

Price: Seed –Rs.11/kg, Linters-Rs.25/kg, Hull-Rs.7/kg, Cake-Rs10/kg, Oil-Rs47/kg

Table 10: Value Additional to Cottonseed By products

Value Added products	Per tonne of seeds (kg)	Price (Rs.)	Cost of Production (Rs.)	Net Profit (Rs.)
Bleached Linters (70% yield)	35	2275	100	2175
Bioenriched Hulls (80% yield)	280	2520	350	2170
Oil	200	9400	-	9400
Meal*	330	8250	1000	7250
Oil from meal (7%)	70	3290	-	3290
Total	**24,285**			

*Preparation of protein hydrolysate from meal (60% recovery) will fetch a further profit of Rs. 62040/- (Rs. 59,400 + Rs.2,640)

Price: Bleached Linter-Rs.65/kg, Solvent extracted meal-Rs.25/kg, Protein hydrolysate Rs.800/kg.

The value addition to by-products is given in Table 10. One can realize a total amount of Rs. 24,285/- as againts an amount of Rs. 15,850/- when sold as it is. In other words a net gain of Rs. 8,435/- could be realized on value addition to the by-products.

Cottonseed Oil

The production of cottonseed oil during 2006-07 was 9.89 lakh tonnes againts 8.14 during 2005-06. The cottonseed contains about 18-25% oil depending on the quality of seed and the species. The oil is primarily used as a medium for frying and for manufacture of hydrogenated vegetable products, cooking, salad dressings and for production of soap. This is one of the important edible oils and is mush superior in its nutritional value to many of the traditional oils. As per an estimate, about 90 lakh tonnes of cottonseeds produced in India can yield approximately 15 lakh tonnes of oil. The nutritional value of cottonseed oil is around 9 kcal/g, the average digestibility is around 97% and could be compared with that of soybean, safflower and sunflower. The oil with practically no gossypol is pale yellow in colour and rich in Vitamin-E and can be used directly as a cooking medium and also for the manufacture of Vanaspati. The keeping quality of oil is also quite good and is comparable with other edible oils.

Utilisation of cottonseed oil for human consumption should receive immediate attention in our country for meeting the shortage of poly – unsaturated fatty acids and is very ideal inhuman diets. This oil is very popular in USA. However in India, it is being used to a very small extent. Therefore efforts are to be made on a war footing to popularise its import of other edible oil, atleast to some extent. Efforts are also needed to popularise cultivation of varieties of cotton with high percentage of oil (25%).

Why the cottonseed oil is highly acceptable as an edible oil?

Even though cottonseed oil is darker in colour than soybean, peanut and other traditional oils, the impurities and pigments are reality removed by modern refining and bleaching techniques to produce light colour.

It possesses properties that makes it suitable for processing in salad oil. The proportion of highly saturated glycerides is such that when the oil is chilled slowly the higher melting glycerides saparate out and can be readily removed by filtration which do not get crystallised when held at 40° to 45°F. The high melting portion is generally utilised in blending oils for shortening or in hydrogenated products.

It contains traces of fatty acids with unsaturation greater than linoleic acid . On hydrogenation, the

unsaturation decreases and stability is further increased. unlike soybean oil, this oil has greater resistance to flavour reversion.

The stability is also due to the preasence of antioxidants namely tocopherols.

Refined cottonseed Oil

It is one of the few oils which is in "OK FOOD" list of American Heart Association(AHA). The oil is nutritive as is certified by AHA. It is safe and suitable for human consumption. It contains 50% linoleic acid which is required in human diet as it is not biosynthesised in our body. The fatty acids are essential for synthesis of various hormones without which the internal vital organs of our body cannot function properly.

Another advantage is that it does not allow speedy blockening of coronary arteries by forming hard pellets of cholesterol. In view of the above, cottonseed oil should be made mandatory to be used in the form of blend either with oil or with hydrogenated vanaspati. It can also be supplied in the form of encapsulated materials. The fatty acid profile is given in Table 11.

Table 11: Fatty Acid Composition of Various Edible Oils

Oil Source	Fatty Acids (%)						
	Myristic (14:0)	Palmitic (16:0)	Stearic (18:0)	Other	Oleic (18:1)	Linoleic (18:2)	Linolenic (18:3)
Cottonseed	0.79	24.70	2.20	-	20.87	50.76	-
Groundnut	-	13.69	1.96	3.28*	52.13	2894	-
Sunflower	0.38	4.27	5.46	-	49.41	40.48	-
Safflower	1.50	3.00	1.00	-	33.50	61.00	-
Til	-	10.02	5.85	-	40.11	44.02	-
Soybean	-	10.33	3.86	-	26.52	52.92	6.37
Corn	-	14.98	1.31	-	34.12	49.59	-
Mustard	-	2.10	0.39	3.01*	10.31	13.80	11.52
Coconut	18.76	8.38	2.18	62.17*	6.96	1.55	-
Palm	1.50	45.00	4.00	-	39.00	10.50	-

** This includes caproic, caprylic, capric, lauric, arachidic, dehenic and lignoceric either all or few in different properties palmitoleic (16:1), Cottonseed 0.68% Mustard 0.26% Elcosenoic (20:1), Musrard 7.39% Decosenoic (22:1), Mustard 51.2%*

II) Utilisation of Industrial Waste Compost

Ginning is the first mechanical operation that the seed cotton undergoes during which the lint is separated from seed. Indian cottons fetch lesser price even in the domestic market as they contain large amounts of trash in baled lint. Foreign cottons being less trashy and contaminant free, Indian mills are resorting to cotton imports. This definitely affects the price of cotton and recently it has been observed that farmers are inclined to switch over to other crops. The sincere efforts of Govt. of India to modernise market yards and ginning and pressing industries under Mini Mission III and IV of Technology Mission on Cotton have already started showing positive results in producing clean cotton bales on par with International Standards.

The introduction of pre and post cleaners coupled with other best management practices of machine handling conveying and of cotton produces different kinds of unspinnable cotton wastes and trash in modernised ginning and pressing factories. These units need not be alarmed by this increased wasted generated during processing. In fact, the following are the advantages.

a) Modernised G & P factories are producing clean cotton which can definitely fetch better price.
b) The loss incurred during the process i.e. short fibers and trash can be put to better value addition.

Preparation of Compost

Composting is an aerobic process and based on field trials it has been shown to be possible to produce good quality compost from ginnery waste. The proximate chemical composition of ginnery waste is given below.

Table 12: Proximate Chemical Composition of Willow-dust and Cattle Waste

Constituents	Willow-dust (%)	Cattle Waste (%)
Ash (including sand)	10-12	15-18
Cellulose	24-28	27-29
Hemicellulose	15-18	25-26
Lignin	14-16	16-18
Nitrogen	1.0-1.5	1.0-1.2
Ether extractives	4-6	3-4
Water solubles	22-25	9-10
C/N	28-30	30-32

The process is simple which involves mixing of the waste with dilute alkaline solution and microbial consortium, heaping, turning every week and a stablised compost production at the end of four weeks. The economics are detailed below.

a) Quality of Ginnery waste to be processed weekly = 12 tonnes (Rs. 1200/-)
b) Requirement of land 7 m x 3 m (54 m^3 for a batch of 12 tonnes heap size) (the cost of land has not been taken into account)
c) Construction of water tank to hold 10,000 liters of water (Rs. 60,000/-)
d) Concrete mixer with 5 HP motor (Rs. 1,20,000/-)

Running Cost:

		Rs.
(i)	Water (7200 liters)	72.00
(ii)	Alkali (12 kg) commercial grade	144.00
(iii)	Labourers (4) @ Rs. 100 per day	400.00
(iv)	Mixer Running Time (Rs. 125 per 8 h)	125.00
(v)	2 HP pumpset running time (Rs. 90 per 8 h)	90.00
(vi)	Miscellaneous expenses	849.00
	Depreciation @ 10 %	320.00
	Total	2000.00
Expected manure production 6 tonnes/ heap		-
Expected Income	Rs. 12,000/heap	
Net Profit (per week)	Rs. 10,000/heap	

The compost prepared from ginnery waste was found to be good quality and analysis of compost is given below.

Table 13: Analysis of Compost

Parameters	From Ginnery Trash (%)	From Cowdung (%)
Nitrogen	1.80-2.00	1.22-1.30
Phosphorus (P_2O_5)	0.80-1.00	0.62-0.70
Potassium (K_2O)	1.70-2.00	1.20-1.40

It is worthwhile to emphasise the urgent need to encourage the application of organic manure in view of the fast depletion of micronutrients in Indian cropped soils on account of continued application of synthetic fertilisers. Soils have become either acidic or alkaline/sodic apart from underground water being polluted due to heavy application of fertilisers. Organic farming is increasingly becoming popular to maintain the soil health which also improves water holding capacity, nutrient build up and soil erosion. The present process of conversion of ginnery trash to compost is one step forward in providing organic manure for crop raising.

Willow dust is a textile mill waste and is rich in cellulose, hemicellulose and lignin. Cellulosic substances with a carbon-nitrogen (C:N) ratio of 25:1 are reported to be optimum for biogas production. As the C:N ratio of willow dust (28-30:1) being close to this optimum level, it has been found suitable for biogas production. The proximate analysis is given below.

Table 14: Proximate Chemical Composition of Willow-dust Cattle Waste

Constituents	Willow-dust (%)	Cattle Waste (%)
Ash (including sand)	10-12	15-18
Cellulose	24-28	27-29
Hemicellulose	15-18	25-26
Lignin	14-16	16-18
Nitrogen	1.0-1.5	1.0-1.2
Ether extractives	4-6	3-4
Water solubles	22-25	9-10
C/N	28-30	30-32

On the basis of the experiments carried out at laboratory scale, an experimental plant for batch type fermentation was designed and fabricated. This plant had the capacity to handle 100 kg of willow dust. The plant consists of an anaerobic batch fermenter and a separate gas holder constructed from galvanized iron sheets. The anaerobic fermentation tank was totally closed expect for one opening of 180 mm diameter at the top to feed the material and a similar size outlet to take out the digested slurry. The biogas, generated was led to the gas holder was of the floating type designed to store 500 liters of gas over water.

The process involves mixing of willow-dust in water (1:1.5) containing sodium hydroxide (1%) and aerobic digestion for 72 h. The aerobically digested material was charged in the anaerobic digester with cattle waste (10%) as inoculum. The total solids in the fermenting slurry was maintained at 16% in the beginning.

The studies carried out on this plant indicated that during the first 6 days after charging the digester with willow dust, biogas rich in carbon dioxide was generated. In the subsequent period, the gas produced was combustible and the methane percentage increased to 55-60%. As much as 17 m^3 biogas was obtained from 100 kg material in 30 days. About 50 kg of the material remained in the slurry was found to be of a good quality manure.

This digested slurry was tested for its manurial value. It was found that the digested slurry had better NPK content than the slurry obtained from cattle waste.

Biomanure

The biomanure obtained after fermentation can be directly used for plants, unlike the spent slurry from cattle waste based biogas plants which requires dewatering or sun drying for immediate use.

Analysis of willow-dust along with that of biomanure obtained from willow-dust and that of cattle waste is given in Table 6. It is observed that willow-dust manure is having better NPK content than cattle-waste.

To assess the manurial value of the biomanure obtained from willow-dust, pot culture trials were under taken on a crop of Laxmi variety cotton using red sandy loam soil. Three sets of pots were taken. One set received 500 g of biomanure obtained from willow-dust. Another set received a basal dose of 1.5 g ammonium sulfate, 4.0 g super phosphate and 1.5 g potassium sulfate. This set again received the same dose of fertilizers after one month of sowing as top dressing. The third set served as control and did not receive either fertilizer or willow-dust manure. The stand of crop on the biomanure of willow-dust was found to be comparable to that of fertilized crop (Balasubramanya, 1982).

Further experiments in the field condition on cotton crop under irrigated conditions indicated that the application of the biomanure prepared from willow-dust at the rate of 5 tonnes per hectare is equivalent to 10 tonnes of FYM or 80:40:40 of N,P and K per hectare.

Attempts were made to reduce the amount of water in the fermenting mass. It was possible to produce biogas as effectively as before with a substrate to liquid ratio of 1:1.5. In this process, the alkali treatment and aerobic digestion remained unaltered. However, with the substrate to liquid ratio of 1:1.5, biogas production started after 10 days, as compared to 7 days when substrate to liquid ratio was kept at 1:5. By following this technology, it is now possible to charge the same 100kg experimental biogas plant with 200 kg material, thereby getting twice the gas yield from the same unit space.

Pilot Plant Study

A pilot plant to process willow-dust for biogas production was commissioned at Apollo Textile Mills, a unit of the National Textile Corporation, with financial assistance from the Ministry of Non-conventional Energy Sources (MNES), Govt. of India under an operational research programme.

The plant was constructed on 104 Sq. Mtr. land. There were six batch digesters, each of 2.40 m x 2.40 m in size, with a capacity to handle 2 tonnes of willow dust when the substrate to liquid ratio is 1:6. The digesters were constructed by reinforced concrete and are partially underground. For the initial digestion, an open tank of 8.0 m x 2.4 m x 2.5 m, and for collection of slurry, a tank of 4.8 m x 2.4 m x 2.5 m have been provided. The digesters could handle 4 tonnes of willow-dust each when the substrate to liquid ratio was reduced to 1:1.5. The digesters were separately connected through gas flow meters, which, in turn were connected to a common gas holder through a header. Each digester had a separate bypass for the carbon dioxide generated during the initial stages of biogas production. The gas holder was of floating type and constructed from mild steel sheets. The weight of the drum was adjusted to exert a constant pressure of 25cm water column pressure. The gas holder had a capacity to store about 70 m3 of biogas.

A number of trials were taken on this plant and data were collected. Based on the trial, modification and improvements were made subsequently.

Installation of a Biogas Plant

M/S century Yarn located at a distance of about 90 km from Indore, Maharashtra generates about 400 kg of cyclone dust every day. A semi-continuous plant to process about 150 kg waste was installed in the mill in the year, 1998.

Design

The plant was constructed by using brick masonry structure. The water portion, which was built

using RCC work, is positioned at the top of the digester. The plant is of hexagonal shape to facilitate easy flow of the substrate from inlet to outlet. A slope at bottom of inlet portion gives extra momentum to this flow. The digester cover and gas holder are combined into a single unit. This cover-cum-gas holder moves up and down in the water seal. Suitable guiding arrangement is made for the easy movement of the gas holder. The gas holder is fabricated from mild steel sheets, angles and flats. FRP coating is given on inner and outer surface of gas holder. The volume of the digester is about 40 m^3. The weight of gas holder was adjusted to exert a constant pressure of 5 cm water column when it is floating.

Installation of Biogas plant based on cyclone-dust at Century Textiles & Industries Ltd., Mumbai was completed in 2003. The plant has two batches fed digesters to accommodate 10 tonnes of cyclone-dust in each digester with a common gas holder. The gas produced is being used in their canteen and the plant has been working satisfactorily to date.

CIRCOT has developed methods to produce biogas from these materials both by a semi-continuous and a batch fermentation process. Both the advantages and disadvantages of these methods are given below.

Semi-continuous Process

Advantages	Disadvantages
Only one digester	Charging everyday
Low capital cost	High water requirement
	Slurry handling difficult
	Low solid loading

Batch Fermentation Process

Advantages	Disadvantages
Charging Everymonth	High Capital Cost
Water required less	Two or more digesters required
Slurry handling easy	
High solid loading	

Over the year. after rigorous analysis CIRCOT has now come out with a new approach for disposing small quantities of waste generated in Ginneries which has the potential for easy acceptance by the ginners.

Salient Features of the Process

Primary Digester	One
Semi-continuous Plant (KVIC type)	One
Raw Material Requirement	100 kg/day
Capital Investment	Rs. 1,00,000/-
Biogas Production (15 cyl. of 14.5 kg)	450 m^3/month
Biomanure Production	1.5 tonnes/ month
Running Cost	Rs. 1000/ month
Net Income	Rs. 8000/ month
Pay back period	One year.

The organic acids produced during digestion in the Primary digestion in the primary digester are taken out adding appropriate quantities of water and the leachates are fed to the anaerobic digester. The gas generated can be utilized by the families in and around the ginnery atleast by 10-15 of them depending on the size of each family.

Source : AICOSCA Newsletter, May 09, pg 11 to 19

NO MORE TRANS

Catalyst avoids transformation

University of California-Riverside (USA) chemists have designed a catalyst that allows hydrogenated oils to be made while minimizing the production of *trans* fatty acids (TFA).

In their experiments, the researchers, led by Professor of Chemistry Francisco Zaera, used platinum, a common industrial catalyst. By controlling the shape of the platinum particles, the Zaera group was able to make the catalyst more selective.

Catalytic selectivity refers to the ability of a catalyst to select a specific pathway from among many possible chemical reactions. In the case of the researcher's experiments, selectivity refers to the production of partially hydrogenated fats without the production of TFA.

Zaera's lab found that the plantium catalyst performed most selectively when its particles assumed tetrahedral shapes, with the atoms arranged in a hexagonal honey-comb lattice. Particles with these shapes allow for the preservation of the harmless *cis* configuration in the hydrogenated fats. Other lattices, the researchers found, favor the production of *trans* fats.

Platinum catalysts such as those used by the Zaera group are consideration heterogeneous because they exist in a different phase (solid) from the reactants (liquid or gas). Compared with homogeneous catalysts, where the catalyst is in the same phase (liquid) as the reactants, heterogeneous catalysts have the advantages of easy preparation, handling, separation from the reaction mixture, reuse, high stability, and low cost.

But their main disadvantages is that, unlike homogeneous catalysts, which tend to be molecular, heterogeneous catalysts must be dispersed as small particles in a high surface-area support in order to optimize their use. This typically results in catalysts with surfaces of ill-defined structures.

The research by Zaera and his coleagues is a breakthrough, they said, because it shows for the first time that it is possible to achieve selectivity with heterogeneous catalysts like platinum by controlling the structure of their surfaces.

"The more control we can exert on how we prepare catalysts, the more we can control the catalytic selectivity of a particular chemical process," Zaera said. "Our work shows that it is possible to make heterogeneous catalysts that afford us more control on selectivity. This opens the door, we hope, for chemists to think about achieving selectivity for other reactions via the design of specific heterogeneous catalysts with specific shapes."

Zaera explained that heterogeneous catalysts tend to be more practical in terms of manipulation, but are harder to control.

"Our paper shows that, thanks to new advances in nanoscience, sophisticated and highly selective heterogeneous catalysts can be made by controlling their structures." he added. "In this sense, our paper changes the paradigm of heterogeneous catalysis. These catalysts can now compete more closely with homogeneous catalysts, which industry traditionally uses for reactions that require high selectivity such as those involved in the manufacture of medicines or other fine chemicals."

The article appeared in *Nature Materials* (8:132-138, 2009).

Source : Inform April 2009, Pg 212

AT LAST

Mission Newenergy Ltd. declares profit

Focused on developing jatropha as a profitable crop, Mission New Energy Ltd. (Perth, Australia) announced in February that it had achieved its first profit in financial year 2008 and expects to do so again in 2009. At present the company has substantially sold out the production for 2009 of its 100,000 metric-tons-per-year (MT/yr) refinery at Kuantan Port in Malaysia to a major global oil and biofuels players, according to Asia Business News (Feb. 2, 2009). A second plant located next to the first, with a capacity of 250,000 MT/yr, should be commissioned by March 2009. These plants are initially using crude palm oil as feedstock.

However, at the heart of the operations of Mission NewEnergy are commercial-scale jatropha plantations. Mission entered the jatropha business in 2006 and anticipates its first commercial quantity of crude jatropha oil in calendar year 2009. As of December 2008 the company controlled 354,000 acres (143,000 hectares) of jatropha plantations, and it anticipated expansion to more than 550,000 acres (223,000 hectares) in 2009. It expects to receive its first commercial quantities of crude jatropha oil in 2009 and predicted its jatropha oil in 2009 and predicted its jatropha business in India would be cashflow positive in the first quarter of 2009.

Source : Inform, April 2009 Pg 217-218.

CHUG AWAY

India's trains accelerate adoption of biodiesel

In 2002, Indian Railways, which is operated by the state, was approaching bankruptcy, in part because of bills for diesel to fuel the trains. To achieve greater economies, the trains. To achieve greater economics, the company looked for substitutes for diesel, particularly biodiesel made from oil extracted from jatropha seeds. This plant grows wild in the country and has no use for food because of the toxicity of the oil.

Now Indian Railways is producing about 1,000 liters of biodiesel daily at its own plant in Perambur. Feedstocks include oil from jatropha plants growing in the right-of-way beside the train tracks and used cooking oil from hotels and restaurants, according to a January 30 article by Jon Evans in the Biofuels, Bioproducts & Biorefining newsletter (www.biofpr.com/details/features/142561/Allaboard.html). This volume replace about 10% of petrodiesel in many of its locomotives.

Indian Railways plans to sponsor the cultivation of many more jatropha plants and to establish a network of biodiesel plants, with a goal of producing 53,000 gallons (200,000 liters) of fuel annually.

The Indian government has also joined the effort to produce more biodiesel from jatropha. Despite early resistance of farmers to planting jatropha, owing to fears about its profitability , 350,000 hectares are being developed as jatropha plantations, and biodiesel plants are being constructed, for example, by Naturol, Tree Oils India, and Southern Online Bio Technologies, all of which are in Hyderabad, Andhra Pradesh.

The government of India is also setting mandates for the use of biofuels. In 2007 the mandate was for 5%, and in 2008, 10%. The mandate is scheduled to reach 20% by 2017. Domestic production of biofuel is being encouraged.

NOVEL

Conversion of food wastes to biofuels

Renewable BioSystems LLC of Fairfield, New Jersey, USA has licensed the North American rights to manufactures and market a new technology from Agritec Systems Ltd. (Great Longstone, Derbyshire, England) that processes 2-15 metric tons per hour of virtually any type of organic waste (e.g., food processing and supermarket waste, offal from meat processing, dissolved air flotation sludge, fish residuals) into separate streams of oil, water, and solids.

Waste material enters the oil extraction machines and is macerated to a uniform slurry. The latter is steam heated in a kettle, then cooked in an inline cooker. The product is then separated in a three-phase decanter centrifuge into oil, solids, and wastewater, which are sent to separate receiving/storage tanks.

The oil extraction machines has applications in all types of food plants, especially those producing waste streams with large percentages of oil, such as poultry or pastry; and it also can be used by live stock processors, composters, oil seed crushers, renderers, algae producers, and a landfills.

The technology was demonstrated successfully in 2007 at a Cranswick Fine Foods pork processing facility in Hull, England. Cranswick is now producing oil at a rate of 18% of offal processed. The company sells the high-quality oil directly to a Brock lesby (a biodiesel processor in East York shire) facility.

This oil extraction technology not only will create an alternate feedstock for bio-diesel but also will enable food manufacturers to lessen their waste streams and profit from them. RBL estimates the energy costs of extracting the oil with this machine are only 20% that of traditional rendering.

Source : Inform, April 2009, Pg 219

NO FREE LUNCH

EU proposes tariffs on US biodiesel

The European Commission approved plans to impose temporary anti-dumping and antisubsidy duties on imports of biodiesel from the United States for a four-month period starting March 13, 2009, during which time investigation and contact with stake-holders will proceed. Anti-subsidy duties will be •211.20 - •237.00 per metric ton, and •23.60 - •208.20 per metric ton for the anti-dumping measures. At the end of the four months, the four months, the Commission will make a final recommendation to member states of the European Union on whether to impose so-called definitive duties in this case. If imposed these would normally last for five years.

Duties will apply to B99 (a blend of 99% biodiesel and 1% petroleum diesel). In the United States, this fuel receives a $1-a-gallon tax credit from the federal government. European governments contend that this tax credit is an unfair subsidy and accounts for the 40% growth of US imports to Europe in 2008 compared with 2007. The purpose of the duty is to stem the bankrupting of biodiesel manufacturing in Europe.

Companies likely to be affected include Archer Daniels Midland (Decatur, IIlinois), Cargill (Wayzata, Minnesota), Imperium Renewables (Seattle, Washington), Peter Cremer North America (Cincinati, Ohio), and World Energy Alternatives (Boston, Massachusetts).

Source : Inform, April 2009, Pg 219

INTERESTING

New work on omega-3 fatty acids

Diets rich in omega-3 fatty acids protect the liver from damages caused by obesity and the insulin resistance it provokes, according to a study in mice published online in the Federation of the American Societies for Experimental Biology Journal (doi:10.1096/fj.08-125674).

"Our study shows for the first time that lipids called protections and resolvins derived from omega-3 fatty acids can actually reduce the instance of liver complications, such as hepatic steatosis and insulin resistance, in obese people," said Joan Claria, a professor from the University of Barcelona (Spain) and one of the researchers involved in the work.

The scientists found that two types of oxygenated metabolites derived from eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)-protections and resolving – were the cause of the protective effect. To reach this conclusion, the team studied four groups of mice with a gene altered to make them obese and diabetic. One group of mice was fed an omega-3- rich diet for five weeks; another was fed a control diet for a similar period. Both diets contained an equivalent amount of fat (8.4% fat by weight), but in the omega-3 diet. 6% of the total fat content was provided by omega-3 polyunsaturated fatty acids. A third group of mice was injected with DHA every 12 hours for four days, and a fourth group was injected with resolving E1 every 24 hours for four days. After five weeks, blood serum and liver samples from the test mice were examined. The mice given the omega-3 rich diet exhibited less hepatic inflammation and improved insulin tolerance. This apparently was due to the formation of protections and resolvins from omega-3 fatty acids.

'Doctors are always looking for simple and easy ways to counter the harmful effects of obesity, and the great thing about this study is that the information can be used at dinner tonight," said Gerald Weissmann, editor-in-chief of the FASEB Journal.

In related work, scientists from the Colombia University Medical Center (CUMC) in new york (USA) looked at the effect of a diet rich in fish oils on the accumulation of fat the aorta, the main artery leaving the heart.

A CUMC research team led by Richard J. Deckebaum, director of the Columbia Institute of Human Nutrition, has found that the beneficial actions of fish oils that block cholesterol buildup in arteries are found even at high fat intakes.

The study was conducted in three separate populations of mice: one that was fed a balanced diet, one that was fed a diet resembling a Western diet high in saturated fat, and a thirty that was fed a diet rich in omega-3 fatty acids from fish.

Researchers in Deckelbaum's laboratory found that the fatty acids contained in fish oil markedly inhibit the entry or low-density lipoprotein (LDL) chlolesterol into arteries and, as a result, much less cholesterol collected in these vessels. The scientists found that a lower level of arterial LDL was related to the ability of omega-3 fatty acids to decrease lipoprotein lipase, an enzyme that traps LDL in the arterial wall.

The study appeared online ahead of print in arterioscleroises; Thrombosis and Vascular Biology (doi:10.1161/ATVBAHA. 108. 182287) AND WAS SUP- ported in part by grant from tha National Institute of Health.

Source : Inform April 2009, Pg 224-225.

TOOLS?

The concentration of tocols from rice bran oil deodorizer distillate using solvent

Ko, S. – N.,-M,. Lee and I. H Kim , Eur.j . Lipid Sci. Technol. 110:914-919,2008.

Tecols (tocopherols + tocotrienols) have been concentrated efficiently from rice bran oil (RBO) deodorizer distillate using solvent at low temperature. The level of total tocols, total tocopherols, and total tocotrienols in RBO deodorizer distillate (starting material) were 31.5, 14.9 and 16.6 mg/g, respectively. Nine different solvents were tested, and acetonitrile was selected as the optimal solvent for concentraning tocols from the RBO deodorizer distillate. There was a significant ($p<0.05$) incream in the tocol level of the liquid fractions with decreasing up to -20°c. In addition, significant differences ($p<0.05$) were observed in the relative percentages of alpha-tocopherol, gamma-tocopherol, alpha-tocotrienol, and gamma-tocotrienol between the raw sample and liquid fractions obtained at different temperatures using acetonitrile as the solvent. The concentration of the tocols from the RBO deodorizer distillate was temperature dependent, and a maximum of 89.9 mg/g was attained in the liquid franction at -40°C. The relative percentage of tocotrienol homologs in the liquid fraction obtained at -40°C was approximately 80%. With acetonitrile as the solvent, the tocols from RBO deodorizer distillate was -20°C when yield was considered.

Source : Inform April 2009, Pg 243.

PROGRESS

Biolubricants : A global overview

Lou A.T. Honary

About 30 years ago Europeans commercialized biolubricants, in the form of hydraulic oils and chainsaw lubricants. These products were manufactured from renewable resources such as rapeseed oil, not from fossil sources (petroleum). Lubricants such as these had been used previously, during the World Wars and at times of petroleum shortages, but otherwise had not been used routinely.

One brand of rapeseed-based hydraulic oil found its way in the 1980s from Europe to the United States under a Mobil brand name, Environmentally Aware Lubricant EAL 224H, with some success. The 1990s saw serious efforts by US companies to follow the European lead in anticipation of pending government regulations. Most notable were companies such as The Lubrizol Corporation, of

Wickliffe, Ohio, that invested significant amounts of research and development resources to create a series of highly effective additive components or packages from high-oleic sunflower oils. Deere & Company (Moline, Illinois), in cooperation with The Lubrizol Corporation, created the first tractor hydraulic fluid, which was based on high – oleic canola oils.

Also, through funding from the Iowa Soybean Association, the University of Northern Iowa's National Ag-Based Lubricants Center (UNI-NABL) was established in 1991, resulting in the development and patenting of the first soybean oil-based tractor hydraulic fluid. During the 1990s, there was a significant amount of activity and publication expounding the benefits of biolubricants at scientific and trade shows and at standard-setting organizations, including the American Society for Testing and Materials (ASTM) and the American Oil Chemists' Society (AOCS).

For several years, ASTM was bogged down with attempts to define the term "biodegradability," because that was the main focus of these products. This resulted in serious delays in developing standards. Furthermore, the emphasis on environmental friendlines meant that less emphasis was placed on the economics of these products, and sometimes, on the performance. As a results, the initial products either were too expensive, had performance short coming, or both. Neverless, these products found some niche markets. By the end of the 1990s, however, most US companies had reduced or eliminated their green projects.

Research continued, however, in academic and governmental research laboratories or in projects funded by agriculture groups, such as state and national soybean associations. The UNI-NABL continued to grow, and through support from the US Department of Agriculture (USDA) and US Department of Energy it expanded its operation to create vegetable oil-based lubricants and greases. Since its inception in 1991, UNI-NABL has commercialized over 30 industrial lubricants and grease based on soybean oils. During this time, the USDA introduced the term "biobased" and initiated a labeling program requiring federal purchasers to buy products labeled as biobased.

OLD TECHNOLOGY

The initial technology for biobased lubricants – primarily referred to as biodegradable lubricants – was based on vegetable oils that had been subjected to minor chemical treatments and in which performance – enhancing additives were included. Since vegetable oils generally face inherent challenges when it comes to industrial lubricant applications, their initial use required more serious modification. Soybean oil, for example, shows a significant lack of oxidation stability, with an oil stability index (OSI) value of about seven hours. In one case, this oil was partially hydrogented to improve its oxidation stability and then winterized to improve its pour point performance (Honary, 1999). Addition of hydraulic oil additive packages, antioxidants, and pour point depressants resulted in hydraulic oils capable of performing in high-performance hydraulic systems.

Perhaps the most important development for US biobased lubricants was the introduction of high oleic soybeans by the Dupont Corporation (Wilmington, Delaware, USA) in the early 1990s. The oil of this genetically enhanced soybean had a fatty acid profile considerably superior to conventional soybean oils. Genetic modification of seeds allows changes to the fatty makeup of the seed oil that would take longer to make through the natural selection process. The oil from the high-oleic soybeans, for example, had oleic acid contents of less than 3% as compared with 20% oleic and 8% linolenic content, respectively, for typical commodity soybeans. Originally designed for frying applications. this oil showed an OSI value of 192. or a stability about 27 times higher than conventional soybean oils. This characteristic helped in the creation of a number of highly successful lubricants and a number of physicochemical as well as performance differences between conventional soybean oils and high-oleic soybean oils are presented in Table 1. The Lubrizol Corporation built its additive and lubricants technology based on high-oleic sunflower oils. For many industrial lubricants applications, high-oleic soybean oil. sunflower oil. and canola oils are still base oils of choice today.

CURRENT TECHNOLGY

Although high-oleic oils, for the most part, solved

Table 1 - Viscosity, viscosity index, and pour points of selected oils and identical hydraulic fluids utilizing soybean oil- and mineral oil based fluids

Description	ASTM D 6749 pour point (°C)	ASTM D 445 viscosity @ 40°C	ASTM D445 viscosity @100°C	ASTM D 2270 viscosity index
High-oleic oil	-16	31.19	8.424	200
Crude conventional soy	-6	31.69	7.589	222
Mineral oil-ISOVG 100	-50	20.58	3.684	28
Mineral oil-ISO VG 500	-32	96.21	9.040	53
Mineral oil blend of 57%/43% (of ISO VG 100 and 500, respectively		37.95	5.295	53
Hydraulic fluid with crude conventional soy		32.26	7.592	217
Hydraulic fluid with high oleic soy		39.14	8.412	199
Hydraulic fluid with mineral blend		25.24	4.248	46

the problem of vegetable oils' lack of oxidative stability, many of these products required mixing with other [often synthetic] oils to improve their pour point performance. Still, achieving the cold temperature performance for lubricants used outdoors required mixing in of various expensive esters, which sometimes negatively affect the elasto-meric compatibility of final product. As a result, there have been many recent development. including the creation of chemically moditied vegetable oil (i) allow for flexibility in the use of any vegetable oil as a base input and (ii) improve performance both for oxidation and cold temperature.

The chemical modification of vegetable oils to improve their performance for frying and for industrial use is not new. One of the soybean oil-based tractor hydrauic fluids developed in United States was based on partially hydrogenated soybean oil that had reasonable oxidation stability and that further winterized to help with the pour point performance. This oil, in fatty acid profile and in many other properties, is similar to common winterized salad-quality oils. Of course, additional additives such as antioxidants and pour point depressents were needed to formulate and meet the requirements of hydraulic oils. Today, chemical modifications are created with the industrial or automotive lubricants in mind, not frying stability needed in food applications. This focus has resulted in significant strides in creating products that are more flexible in their raw materials input as well as in showing oxidation stability and cold temperature performance far superior to what is possible by mixing and by using pour point depressants. These new modification methods are promising and are opening the opportunity to go beyond industrial lubricants and test products for automotive lubricants such as engine oils.

Estolides are one example of these new chemical modification techniques. A patent by Steven Cermak and colleagues describes the creation of estolides for industrial and automotive lubricants (US patent number 6316649). An example of a process for synthesizing estolides from coccanola as provided by Cermak is presented in Figure 1.

The estolides are created by "chemically connection different unsaturated fatty acids (FA). These are the building blocks of high oleic oils, such as sunflowers, canola, and lesquerella" (Suszkiw, 2006). Using only the FA components, USDA researchers produced "branched chains of either saturated or unsaturated oleic estolides whose performance in various tests rivaled that of mineral oil-based lubes. These estolides showed pour points down to -22oF (-30oC) for the unsaturated oleic estolides and -40oF (-40oC) for the saturated ones; and oxidative breakdown of 200 and 400 minutes in rotation bomb oxidation tests (RBOT) (200 minutes for a comparable mineral engine mineral engine oil" (Suszkiw, 2006).

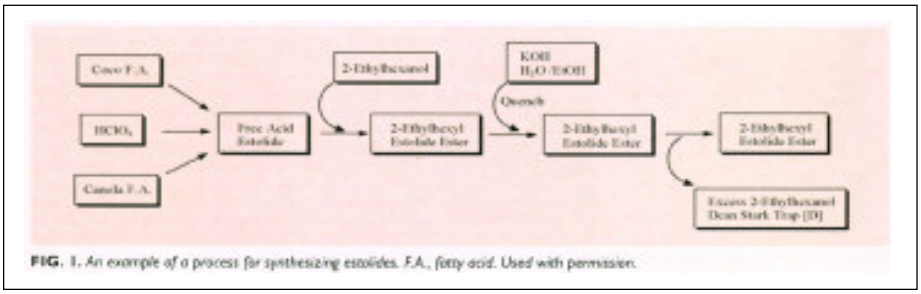

FIG. 1. *An example of a process for synthesizing estolides. F.A., fatty acid. Used with permission.*

The Journal of Synthetic Lubrication has published numerous papers on synthetic esters. Some of these complex esters may be made via the reaction of a

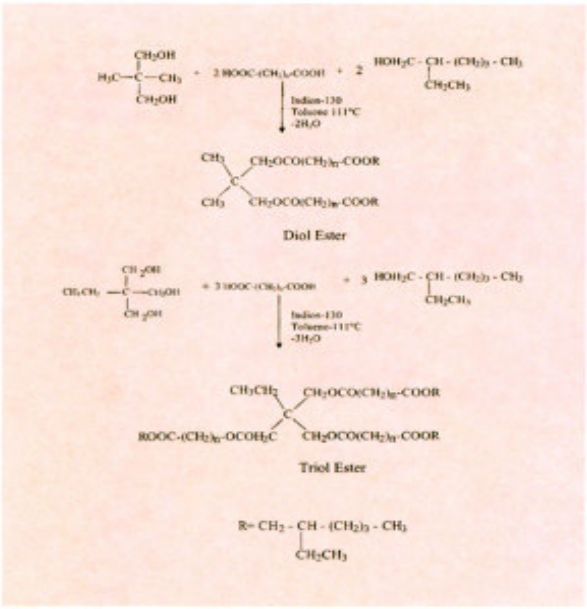

FIG. 2. *Key structural features of these complex esters and basic structure of alkoxy group from the end-capping monoalcohols. Source: Nagendramma and Kaul (2008).*

polyol, diearboxylie acid, and nonoalcohol as an end-capping agent. Key structural features of these esters and the basic structure of the alkoxy group from the end-capping monoaleohols are presented in Figure 2.

FUTURE TECHNOLOGY

The popularity of biofuels over the last few years has resulted in a significant investment of public and private capital for the development of alternative crop oils. Although different in end use, many of the industrial crops and special processes developed for biofuels have applications in biobased lubricants as well.

Additionally, the attention given to the negative health effects of trans fats re-invigorated the development by companies such as DuPont and Monsanto of special varieties of oilseeds such as low-linolenic and high-oleic soybean oils.

The Association for Advancement of Industrial Crops has a list of several alternative industrial crops on which members of its oil crop division are working. Most noteworthy are cuphea, camelina, canola, caster, lesquerella, peanut, and pennycress. Camelina has already reached the commercial productions stage; and reasonably large acreages are currently being produced in nontraditional oilseed regions of the western United States.

UNI-NABL recently entered into a multidisciplinary research network lead by AOCS member company Linnaeus Plant Sciences. The Industrial Oil Seed Network is supported with a $3 million grant from Agriculture Canada and brings together tribologists, molecular biologists, agronomists, and experts in greenhouse gas analysis to work together for the first time to increase market penetration of biobased lubricants. The goal is to develop crops with improved oil profiles for specific industrial applications.

Over the last 30 years, the commercial viability and economic and technical performance of biobased lubricants have been established. Because of the demand for petroleum and the attention to the carbon footprint of industrial products, there will be continued developed and enhancement of biobased products. The future technologies will encompass the old fatty acids; the newer genetically enhanced high-oleic varieties; and the more sophisticated. economical, chemical modified, high-functioning esters derived from an ever-growing variety of raw materials. These developments will not completely replace the use of petroleum for industrial and automotive lubricants ,but they will achieve increasing levels of market penetration and capture a significant portion of those lucrative markets.

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