Tall Oil Fatty Acid Marketing[1]

LOUIS G. ZACHARY, Union Camp Corporation, Wayne, NJ 07470

ABSTRACT AND SUMMARY

Once considered a low cost by-product of crude tall oil fractionation, tall oil fatty acids are now being used for their own distinctive and specific properties in special applications. Consumption of tall oil fatty acids in protective coatings, soaps, and ore flotation has declined in recent years, however, usage in chemical intermediates has increased significantly in the past 10 years. These intermediates are dimer acids, oleic and linoleic acids, epoxidized esters, amidoamines, and diacids. Static tall oil production during the mid 1970s caused by changes in paper mill operations (i.e., continuous digestion, waste recycling, increased usage of chips and hard wood) has increased the demand for higher priced oleic acid and other unsaturated fatty acids.

Twenty-five years ago I first started selling tall oil. At that time, if anyone asked where is tall oil marketed, the only answer that I could have given was, "anywhere we can." Our product line included only two grades—crude tall oil and acid refined tall oil—acid refined was simply an acid treated crude. Finding any market, no matter how small, was important to Union Camp.

But fortunately about that time the Arizona Chemical Company paved the way for a whole new industry by successfully fractionating and marketing the two principal components—tall oil rosin and tall oil fatty acids. During the next 10 years nearly a million tons of fractionating capacity were installed by an optimistic young industry that had found a new inexpensive source of tall oil rosin (Table I).

Rosin was the principal reason most of the new fractionators had for entering the business; e.g., Hercules, Cyanamid through Arizona, Crosby, Newport (now Reichhold), even the Monsanto half of Monsanto-Emery—all fractionated tall oil to supplement their rosin requirements since they were anticipating the decline of gum and wood rosin.

In a sense then, tall oil fatty acid was a by-product of crude tall oil which was a by-product of pulping, and therefore the marketing philosophy "anywhere you can" carried over to this product as well. It meant providing the consumer with sufficient incentive to enable him to replace existing fatty acids and oils. In this case with tall fatty acids being the by-product of a by-product, it was not too difficult to provide the incentive—lower price.

The net result was the extremely rapid growth experienced by the tall oil industry especially up through the mid to late sixties.

Table II indicates the amount of crude tall oil recovered, as far back as we have data. As shown, the growth was rapid at least until about 1969, growing about 14-fold from 1943 till 1969 and then staying static—except for the recession decline in 1975.

The fractionators in their early enthusiasm at the rapid acceptance of their products as well as their belief that crude tall oil production would grow in conjunction with the paper industry, built capacity that soon outstripped the available crude tall oil supply.

The paper industry did grow at the anticipated rate, but crude tall oil production did not. Table III shows that southern pulp production increased from 14.4 million tons in 1966 to 21.1 million tons in 1976, a 50% increase; however, crude tall oil production only increased from 638,000 tons in 1966 to 742,000 in 1976, a disappointing 16% increase.

What caused the fractionator's miscalculation? It was simply the numerous technological changes that were taking place in the paper industry. These were far more important to the paper producers than the recovery of crude tall oil.

During this period the paper industry began switching from batch digestion of pulp to Kamyr digesters—this is a continuous digestion process offering significant improve-

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TABLE I

Tall Oil Fractionators[a]

Tall oil fractionator	Date of initial installation	Current capacity, M tons
Arizona Chemical Co.	1949	150
Crosby Chemicals, Inc.	1955	155
Hercules Inc.	1956	237
Monsanto/Emery	1958	65
Reichhold Chemicals Inc.	1954	96
Sylvachem Corp.	1958	100
Union Camp Corporation	1956	105
Westvaco Corp.	1956	85
	Total	993

[a]Source: Pulp Chemicals Association.

TABLE II

Crude Tall Oil Produced and Processed[a]

Year	Crude tall oil produced, M tons	Crude tall oil processed, M tons
1943	57	16
1944	82	40
1945	98	54
1946	108	67
1947	111	53
1948	139	55
1949	123	45
1950	149	55
1951	178	62
1952	154	52
1953	176	56
1954	199	62
1955	300	79
1956	314	74
1957	290	64
1958	332	206
1959	401	272
1960	400	332
1961	424	364
1962	439	385
1963	490	426
1964	569	487
1965	588	536
1966	638	626
1967	617	626
1968	703	639
1969	743	697
1970	759	706
1971	765	709
1972	783	741
1973	793	746
1974	727	658
1975	614	520
1976	742	656

[a]Source: Pulp Chemicals Association.

TABLE III

Growth of Paper Industry and Crude Tall Oil[a]

Year	Southern sulfate pulp production, M tons	Crude tall oil production, M tons
1966	14,387	638
1967	13,938	617
1968	14,573	703
1969	17,307	743
1970	17,602	759
1971	18,862	765
1972	19,914	783
1973	20,488	793
1974	20,106	727
1975	18,455	614
1976	21,086	742

[a]Source: Pulp Chemicals Association.

TABLE IV

Tall Oil Fatty Acid Production[a]

Year	Tall oil fatty acid production, MM lbs
1970	400
1971	407
1972	429
1973	412
1974	363
1975	293
1976	374

[a]Source: Pulp Chemicals Association.

ment in pulping efficiency but resulting in reduced yields of crude tall oil.

Also, the industry changed its method of wood handling. Rather than shipping and storing wood as round logs, they began switching to chips, and in fact chipping at the logging site. The longer the wood is stored as chips, the greater the loss of crude tall oil.

Further aggravating the situation, many paper companies have built saw mills. Lumber is cut from the center of the tree and the rest is chipped, pretty much bark and all, for use in paper-making. The economics of this method of operation outweighs the crude tall oil lost in the heart cut.

In addition, with clear cut harvesting of woodlands, another recent phenomenon, hardwood, is harvested along with the pine. Since hardwood does not contain tall oil, yields are further affected.

More recently, recycling of paper has had its effect. Needless to say, you can only recover the chemicals in pulp the first time around.

If all these losses had not taken place, the industry would be ahead about 250,000 tons of crude tall oil per year. The current fractionating capacity would be completely utilized. and the conclusions to be reached by this paper would probably be totally different. But these changes in the paper industry have taken place, and the net result has been the stagnation in the production of tall oil fatty acids and rosin for the past 5 years.

The tall oil fatty acid statistics (Table IV) alone tell the story. Since 1970, production of tall oil fatty acid has, if anything, declined.

As to the future, one might hopefully say that most of the damage has been done—that future increases in paper production should show corresponding increases in crude tall oil production. Unfortunately, however, the answer is not clear cut. One possibility is that crude tall oil production could be increased by injecting pine trees with an insecticide called paraquat. This treatment, 12 to 18 months before harvest, increases rosin yields up to 300%. Unfortunately, however, fatty acid yields would decline probably by as much as 10%. Paraquat treatment, however, has *still not* been proven to be commercially feasible. The answer is still several years away.

In the mean time we do anticipate that crude tall oil yields will begin to correspond with increases in pulp production which will fall in the range of 2-4% per year. Today there is a new emphasis on improving the recovery of the available crude tall oil. Several promising procedures are currently being investigated. In fact, yields in the first quarter of 1977 have been the best ever.

Nonetheless, since tall oil fatty acids have been limited in availability because of the lack of crude, a significant change has taken place in marketing practices since those earlier days. No longer are tall oil fatty acids offered at a significant discount relative to other fatty acids or soya oil in order to induce the consumer to purchase them.

In years past, the value of top quality tall oil fatty acids was determined by a formula that probably went something like this: the price of soybean oil, less the value of the glycerine, less about 2 cents for inducing the coatings manufacturer to switch from soya oil to tall oil would determine the price of tall oil fatty acids. On that basis and with current prices for glycerine or pentaerythritol, tall oil fatty acids of the top quality would sell for about 7 cents per pound less than soybean oil.

During the past 3 years, the true value of tall oil fatty acid relative to other fats has been obscured by the tremendous speculation in fats and oils that took place in 1974, and then further obscured by the severe recession of 1975. A trend began emerging in late 1976-early 1977 which indicated that tall oil fatty acids possibly had a value greater than that of soya oil—the first time in their competitive history. However, the speculation with soya that began again in February 1977 has again obscured any trend that might have been discernible were the soya oil market more stable.

In order to understand why there might be this new independence of tall oil fatty acid prices vs. other oils, it would be well to review the tall oil fatty acid utilization table which is published by the Pulp Chemicals Association (Table V).

Intermediate chemicals in 1967 accounted for 30% of

TABLE V

Tall Oil Fatty Acids—Domestic Utilization[a]
(M lbs)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Protective coatings	78,459	87,345	83,413	90,954	91,188	107,373	97,868	79,170	60,470	71,433
Soaps, detergents, and disinfectants	32,824	33,170	34,177	36,631	40,131	46,385	37,844	35,875	27,424	36,974
Intermediate chemicals	78,862	95,407	115,356	114,943	111,072	123,684	149,815	129,942	111,793	147,636
Flotation	29,180	24,766	26,017	25,475	18,187	21,387	11,595	12,473	11,690	4,601
Hard floor coverings	3,536	2,761	1,804	2,662	3,409	3,103	2,319	2,505	2,385	3,075
Other uses	44,366	43,562	31,204	41,823	38,241	45,459	42,437	40,689	28,050	43,009
Total reported	267,230	287,013	291,974	312,491	302,228	347,391	341,878	300,654	241,813	306,728

[a]Source: Pulp Chemicals Association.

domestic tall oil fatty acid consumption. This has grown so that they accounted for 50% in 1976. Every other specified use of tall oil fatty acid has declined from its peak during this period not only as to percent share of tall oil usage but also in absolute numbers; for example, use in protective coatings has declined from a high of 107,000,000 pounds in 1972 to 71,000,000 pounds in 1976–in flotation from 29,000,000 in 1967 to 4,000,000 pounds in 1976.

So, what are these intermediate chemicals that account for this increasing proportion of tall oil fatty acid utilization? Some of the more important include the following:

1. Dimer acids, which for the most part wind up in the manufacture of polyamide resins which are then used in flexographic inks, chemical maintenance coatings, and as a component in adhesives.
2. Oleic and linoleic acids produced by solvent crystallization, and then separation. The oleic acid is a high quality product which has FDA approval. The linoleic acid fraction is further conjugated and used as a replacement for dehydrated castor oil. It has found increasing usage in epoxy ester vehicles for metal primers.
3. Epoxidized esters of tall oil fatty acid for simultaneously plasticizing and stabilizing PVC.
4. Amidoamines of tall oil fatty acid for benefication of phosphate or iron ores.
5. C-21 diacids made by the addition of acrylic acid to the linoleic portion of tall oil fatty acid. The unreacted oleic portion is then stripped off. The resulting product is a unique and superior surfactant.

Therefore, tall oil fatty acids are being used more and more for their own distinct and specific properties in these special applications and not because they are the most inexpensive fatty acid available.

Today even in the coatings industry tall oil fatty acids are no longer used as the cheaper alternative to soya oil. I pointed out earlier, consumption in coatings has declined. The 70,000,000 pound current usage of tall oil fatty acids is in applications for the most part where the fatty acid molecule is preferred to provide the required resin characteristics and not be limited to the natural properties provided by soya oil.

Again with regard to this fast growing intermediate chemicals market, it is interesting to note further that in four of those five areas outlines earlier; i.e., dimers, oleic and linoleic, C-21 acids, and amidoamines, the tall oil fractionators themselves are taking the dominant position in developing those markets.

This marketing philosophy is then the second most significant trend which will have an increasing effect on tall oil–the trend toward forward integration by tall oil fatty acid producers.

Union Camp, as the latest example, has recently completed a dimer polyamide plant which, when it reaches its maximum capacity, will be consuming at least 50% of Union Camp's current production of tall oil fatty acids. Hercules placed in production several years ago a fatty acid solvent separation plant that separates oleic from linoleic acid. Westvaco pioneered the production of C-21 diacids and has recently announced its intention to build a $5,000,000 plant for the manufacture of specialty chemicals primarily from tall oil fatty acids.

The industry had already made significant strides toward forward integration. Monsanto-Emery from its inception was planned for forward integration of the finished products, and in fact both partners are normally net purchasers of tall oil products.

Sylvachem, the joint venture of St. Regis and SCM, was originally planned for Glidden's own internal consumption of tall oil fatty acids and rosin in coatings and resins, and of course, Reichhold's recent acquisition of the original Newport facilities was based on much the same reasoning.

TABLE VI

Tall Oil Fatty Acids–Domestic and Export Disposition

Year	Total disposition– tall oil fatty acids, MM lbs	Total disposition– tall oil fatty acids exports, MM lbs
1970	424	87
1971	413	81
1972	444	80
1973	411	55
1974	363	51
1975	282	23
1976	387	50

[a]Source: Pulp Chemicals Association.

TABLE VII

Comparison – Tall Oil Fatty Acid Versus Other Unsaturated Fatty Acid Disposition

Year	Total disposition– tall oil fatty acids, MM lbs[a]	Total disposition other unsaturated fatty acids, MM lbs[b]
1966	352	208
1967	340	205
1968	340	218
1969	355	220
1970	424	232
1971	413	207
1972	444	188
1973	411	179
1974	363	248
1975	282	285
1976	387	365

[a]Source: Pulp Chemicals Association.
[b]Source: Fatty Acid Producers' Council.

In fact today all tall oil fractionators are to some significant degree integrated forward from their production of tall oil products.

This trend of integrating may be expected to continue. The market which will probably be most restricted by this integration initially will be the export market. This can be best illustrated by Table VI.

In the export area probably more so than in any other area, tall oil fatty acids initially were sold primarily on price and utilized mainly in soap type applications.

Subsequently, as tall oil fatty acid supplies became restricted, these marginal uses were eliminated so that today as much as 70% of tall oil fatty acid exports wind up in those applications we call intermediate chemicals.

Still, a further trend that now may be expected to develop will put further restrictions on tall oil fatty exports. Forward integrated producers are now moving to export the finished intermediate chemicals rather than the fatty acids.

All the foregoing may give the impression that shortages may develop in tall oil fatty acids–there will be no shortages–prices for one thing will provide the adjustments necessary to keep the market satisfied.

Also, just as during the 1950s and 1960s when tall oil fatty acids pushed aside oleic acid because of its price attractiveness, the mid 1970s with its static tall oil production has brought oleic acid and other unsaturated acids back into favor.

Table VII illustrates the amount of unsaturated acids other than tall oil fatty acids that have been consumed in recent years. The remarkable growth in 1975 and 1976 of other unsaturated fatty acid proves that the market will be satisfied even if it must pay higher prices as it does for oleic acid or takes advantage of the lower priced distilled and partially unsaturated tallow acids.

The tall oil industry itself has not lost sight of this need to provide the marketplace with these other acids. Union Camp for one acquired a tallow and castor oil based fatty acid plant in 1970.

Glidden has begun using its tall oil distillation equipment to manufacture and upgrade soya foots or acid oil to produce a fatty acid quite similar to tall oil fatty acids and to be used where tall oil fatty acids are used.

Thus, where at one time tall oil fatty acids were merely used as cheap substitutes for other source fatty acids and oils, we are now witnessing the opposite phenomenon—attempts to substitute for tall oil fatty acids—the ultimate compliment to the high regard that tall oil fatty acids have achieved. Therefore, I believe we can predict:

1. Tall oil fatty acid production will be limited by the paper industry to a 2-4% per year increase. However, if paraquat treatment proves commercially feasible, tall oil fatty acids growth will become stagnant again.
2. Continued forward integration by tall oil producers in the area of intermediate chemicals.
3. Tall oil fatty acids having unique applications will therefore be imitated by fatty acids from animal and vegetable origin.
4. Less tall oil fatty acid will be exported as is.
5. More will be exported in the form of finished intermediate chemicals.
6. Tall oil fatty acid prices will be less dependent on the price of other fats and oils.
7. The chemical industry's fatty acids requirements, however, will be satisfied whether the source is tall oil, animal or vegetable origin.

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