MGTA 451 National Cranberry Cooperative Case Study

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Introduction

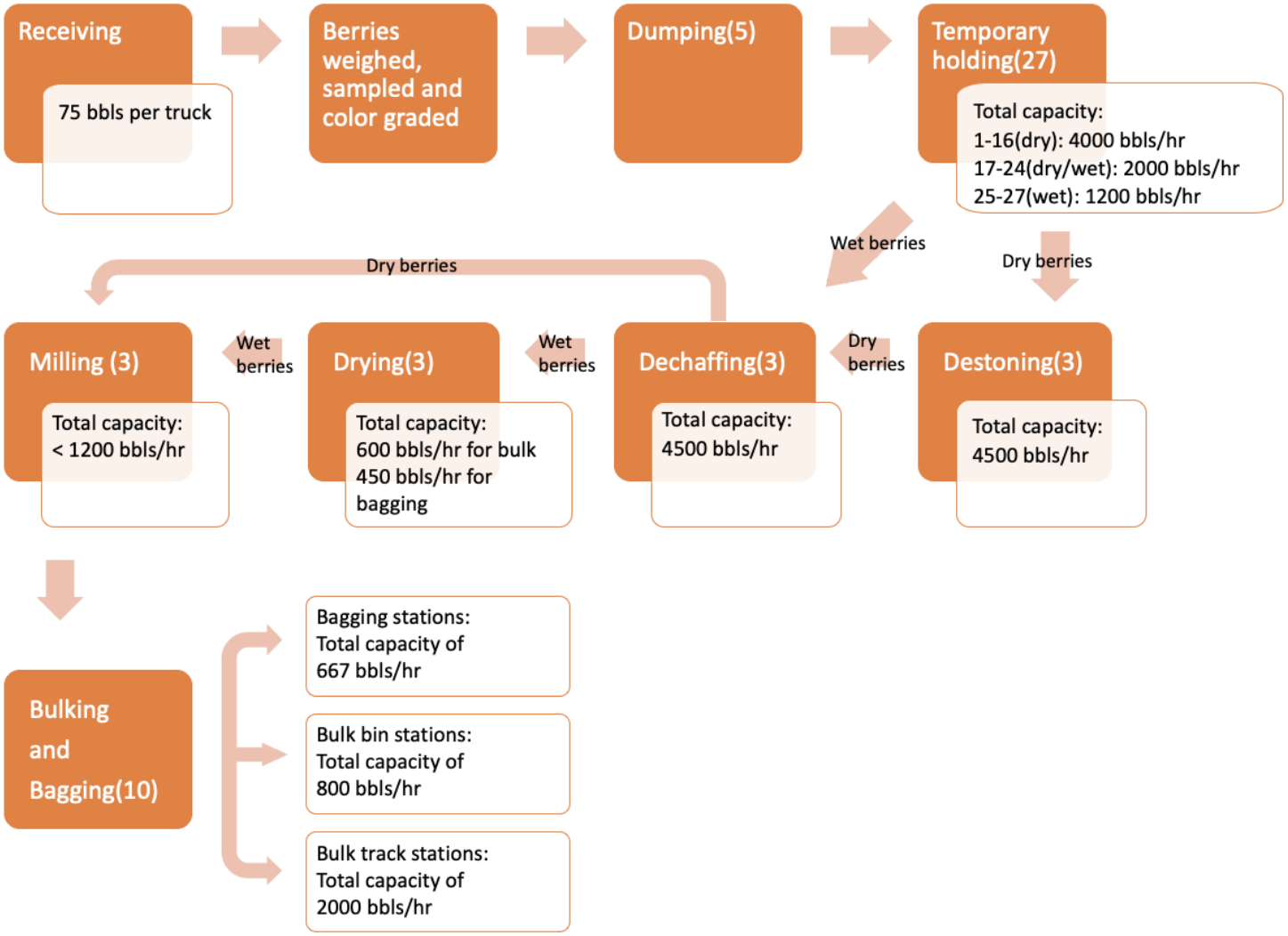
- Problems facing by Receiving Plant No.1 (RP1):
    - Overtime costs are out of control.
    - Growers and drivers spend too much time waiting to unload berries into the receiving plant.
    - During color grading, some 2B berries are miscategorized as No.3 berries. As a result, premium for No.3 berries is overpaid by RP1 to growers.

- Industry trends that are likely to affect cranberry processing:
    - Water-harvesting:
      Greatly increase the efficiency of harvesting the cranberry; however, it is not the preferred harvesting method for fruits that are sold fresh since the water harvesting causes some damage and shortened time that fruit could be held. In general, the RP1 stick to traditional dry harvesting for fresh fruit while it is more inclined to choose water harvesting for fruits that is to be processed (from 58% in 1970 to 70% in 1971).

    - Surplus:
      Through 1937-1968, there had been an increasing surplus of cranberries produced over cranberries that were utilized; however, this trend was most likely to affect cranberry growing instead of processing. Also, the likelihood of production surplus would probably decrease after the execution of the Agriculture Marketing Agreement Act, so the details of this trend will not be discussed here.

- Sources of Variability to which NCC is subjected:
    - Not always possible to find workers who are willing to work at 6 pm.
    - Absenteeism. On average, approximately 75% of the workers are presented every day.
    - Percentage of wet and dry berries being delivered every day.
    - The number of trucks that delivers the berries every day.

Process Flow Diagram



Assumptions and Calculations

	quantity	single capacity	total capacity
Process Fruit Receiving			
No. of dumpers	5		
avg. truck load		75 bbls/truck	
length of dumping process		average 7.5 mins (5-10 mins)	* hold up can be up to 3 hrs
Temporary holding			
1-16 (dry)	16	250 bbls/bin	4000 bbls/hr
17-24 (dry/wet)	8	250 bbls/bin	2000 bbls/hr
25-27 (wet)	3	400 bbls/bin	1200 bbls/hr
max wet holding: 3200 bbls/hr			
max dry holding: 6000 bbls/hr			
Destoning, Dechaffing, and Drying			
Destoning	3	1500 bbls/hr	4500 bbls/hr
Dechaffing	3	1500 bbls/hr	4500 bbls/hr
Drying	3	200 bbls/hr for bulk load	600 bbls/hr
		150 bbls/hr for bagging	450 bbls/hr
Milling (Jumbo Separator)	3	<400 bbls/hr	<1200 bbls/hr
Bulking and Bagging			
Bagging Stations	4		8000 bbls/12-hr period
Bulk Stations	4	200 bbls/hr	800 bbls/hr
Bulk Track Station	2	1000 bbls/hr	2000 bbls/hr

Original Process

Process Fruit Receiving
Average barrels of berries during peak season:
18000 bbls/day, 18000/12 = 1500 bbls/hr
Wet berries during peak season = 1500*70% = 1050 bbls/hr
Dry berries during peak season = 450 bbls/hr

Temporary holding
Max wet holding: 3200 bbls/bin, max dry holding: 6000 bbls/bin
Wet berries that cannot be processed in the dryers are held in the bins
3200/450 = 64/9 = 7.111hr
So after about 7.11 hours (which is after 2 pm), trucks have to wait. Trucks have to wait for a total of (18000-(3200+600*7.111))/600 = 77/9 = 8.56hrs (which is almost 11pm). Total waiting time is about 15.67hrs

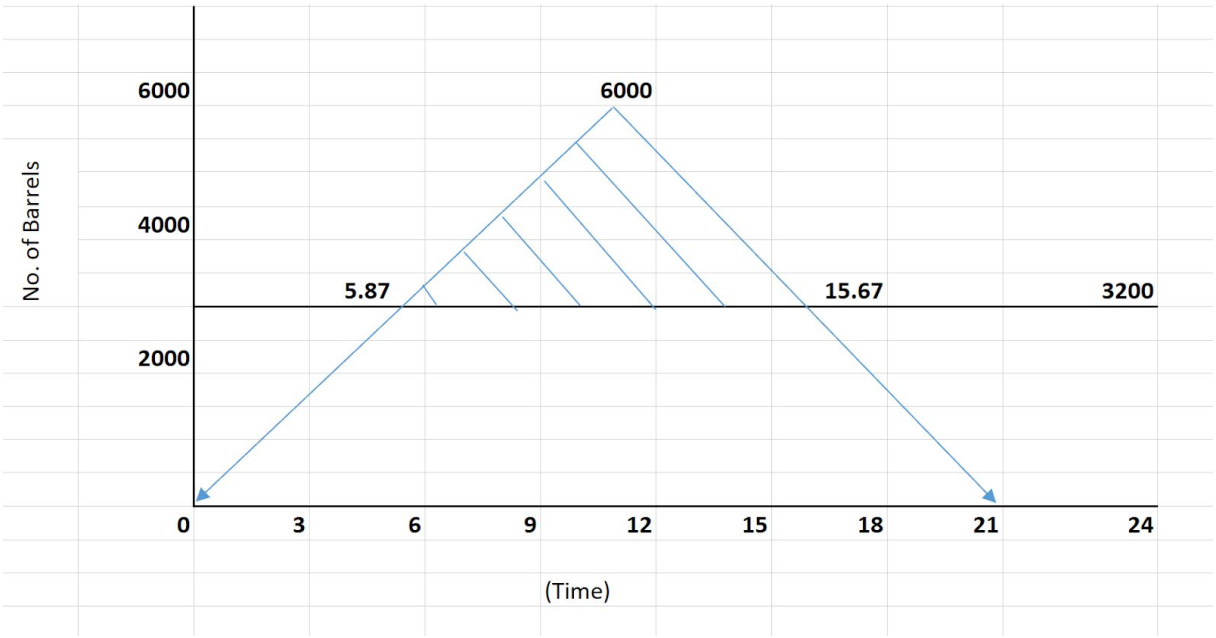
Destoning, Dechaffing, and Drying
Current dryer capacity = 450~600 bbls/hr
Assume larger capacity (200 bbl/hr): 1050-600 = 450 bbls of wet berries are stuck every hour

Milling (Jumbo Separator)
Jumbo separator capacity <1200 bbls/hr
450 + 600 = 1050 bbls of berries are processed every hour
No waiting time!

Bagging
Can process about 3466.67 bbls/hr
No waiting time!

Suppose that a peak harvest-season day involves 18,000 barrels of berries, 70% of them wet, arriving over an 11 hour day. Would trucks have to wait to unload? When during the day would trucks be waiting? How many truck waiting time would you expect?

18000 bbls/day
Water harvesting: 18000 * 0.7 = 12600 bbls/day, 12600 bbls/11 hr = 1145 bbl/hr
Dry harvesting: 18000 * 0.3 = 5400 barrels 5400/11 = 491 barrels/hr
Time to fill the bins for wet berry = Time that trucks started to wait = 3200/(1145-600) = 5.87hr
After 11 hour period, the wet berries remained unprocessed are 12600 - 11*600 = 6000 bbls. 3200 of them went to the temporary holding bins, and 6000-3200 = 2800 bbls remained.
We still need 2800/600 = 4.67 hr to dry all these berries.
The end of the waiting = 4.67 + 11 = 15.67hr



Total waiting time for every truck = (15.67 - 5.87)*(6000-3200)/2/75 = 183hrs

Trucks would have to wait to unload from the 5.87 hours after the beginning of the day to 15.67 hours after the beginning of the day. The total waiting time is 183hrs.

How would the various actions contemplated by Hugo Schaeffer affect peak day performance? Suppose the cost of renting cranberry trucks with driver is $15/hr. What would you recommend? Why?

Possible Solutions proposed by Schaeffer and Walliston:

- **Buy and install two new dryers ($25000) each**
  Temporary holding
  Max wet holding: 3200 bbls/bin, max dry holding: 6000 bbls/bin
  Wet berries that cannot be processed in the dryers are held in the bins
  3200/50 = 64hrs
  Dry berries held in the bins: 450-(1200-1000) = 250 barrels/hr
  4000/250 = 16 hr
  Bins will not be full in the whole process.
  No waiting in the holding process!
  Save 183*$15 = $2745

  Total time for milling: 18000/1200 = 15hr
  Total time for drying: 18000*0.7/1000 = 12.6hr

	Receiving	DDD	Milling	Shipping	Control Room
RT Before	8	8	8	8	8
OT Before	7.67	13	13	13	13
RT After	8	8	8	8	8
OT After	4	4.6	7	7	7
Time Save	3.67	8.4	6	6	6
Full-Time	6	1	10	8	2
Part-Time	9	0	5	12	0

Total labor cost saving =
6*3.75*1.5*3.67+9*2.25*1.5*3.67+1*3.75*1.5*8.4+10*3.75*1.5*6+5*2.25*1.5*6+
2*2.25*1.5*6+8*3.75*1.5*6+2*3.75*1.5*6 = $1301.84
During 20-day peak season, the total saving is (1301.84+2745)*20 = $80936.8 > $50000,
This method is **recommended**.

- **Convert dry berry holding bins so that they can be used to store either water-harvested or dry-harvested berries**
  Currently:
  16 dry bins, 4000 bbls/hr
  8 dry/wet bins, 2000 bbls/hr
  3 wet bins, 1200 bbls/hr
  Max wet holding: 3200 bbls/hr
  Max dry holding: 6000 bbls/hr

  After converting dry bins:
  24 dry/wet bins, 6000 bbls/hr
  3 wet bins, 1200 bbls/hr
  Max wet holding: 7200 bbls/hr
  Max dry holding: 6000 bbls/hr

  We increased wet bins capacity by 4000 bbls/hr. However, if the wet berries are stuck in the drying process, the increase of wet bins capacity still doesn't help accelerate the whole procedure. In addition, it costs money to convert the dry bins. This method is **not recommended**.

- **Install light meter system ($10000 + full-time skill operator at the same pay grade as the chief berry receiver)**
  In 1970, 22% of the wet berry were classified as color No. 3, and 50% of them were turned out to be No. 2B. Assume for the year 1971-1972 harvest season
  1) harvest of 1971 will be the same as that of 1970
  2) 22% of harvested wet berry will be classified as color No.3,
  3) 50% of color No.3 are actually 2B category

  If do not install light meter system:
  This year, the potential overpayment for color No. 3 cranberry will be
  $610,040* 22%* 50%* $0.5 = $33552.2

  If install light meter system:
  Total cost to install the system = $10,000 < $33552.2

  So NCC should install the system as the cost for doing so is less than the potential overpayment for color No. 3 cranberry. The method is **recommended**.

Our suggestions to improve the current situation

1. During High-Volume Period, move the Destone/Dechanff/Dry, Milling and Shipping process at 8 am so that the whole process can start earlier.
2. Create an online appointment system in RP1 for trucks so that trucks' arrival and departure time will be predictable.