"Weather Index Insurance for livestock fodder in dryland System" – Kharif 2015

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Executive Summary

Managing the risks associated with increasingly variable climate is key to successfully adapting agriculture, by reducing the cycle of poverty, vulnerability and dependence brought about by climate-related disasters. Innovations in climate risk management offer win-win opportunities that contribute immediately to agricultural development and improving food security, while building agricultural resilience to changing climates. Lack of location specific insurance contracts, very little awareness, absence of transparency, and delay in getting claims are being cited key obstacles in large-scale acceptance of agricultural insurance by the famers. Hence, Kurnool district was identified to pilot the experiment under dryland systems. The pilot is planned to provide insurance coverage for forage crop to protect small and marginal farmers. Weather stations were available at two villages (V. Bonthrirala and Yerraguntla) of Kurnool district, which are installed by ICRISAT as part of Dryland system program.

Insurance premium was calculated to be Rs. 500/- for a sum of insurance Rs. 5,000/- for variable deficit rainfall in different phases. Total 50 farmers were enrolled for piloting the livestock fodder insurance. Total sum insured during the Kharif 2015 pilot period was Rs. 250,000/- for which total premium collected was Rs. 28,500/- (Rs. 25,000/- as premium and Rs. 3,500/- as tax @ 14%). The risk period was during 15th July and 31st October 2015. It is observed that V. Bonthiralla village AWS received cumulative rainfall of 29.6 mm, 26.4 mm and 1.0 mm during the phases 1, 2 and 3, respectively. While the AWS at Yerraguntla villages recorded 108.5 mm, 151.4 mm and 2.6 mm during the same respective periods i.e., 15th July to 31st August (Phase 1), 1st to 30th September (Phase 2) and 1st to 31st October (Phase 3) of the year 2015. There was a total payout of Rs. 3350 in V. Bonthiralla village and Rs. 1500/- in Yerraguntla villages was realized for the phase-wise deficit rainfall recorded at the respective AWS. Claim disbursement is yet to be done. It is observed from the present study that the phase-wise cumulative rainfall helped the farmers of Yerraguntla to receive Rs. 1500/- per farmer when compared with the previous year's contract which was a cumulative over the season.

I. Introduction

The world's climate is changing fast, and will continue to do so for the foreseeable future, no matter what measures we now take to reduce humankind's impact on it. And as temperatures rise, rainfall patterns and amounts change, and pests and diseases find new ranges, the face of world agriculture will have to change too. Human kind is facing enormous challenges in feeding everyone on the planet. FAO estimates that 842 million people went hungry in 2011-13; that's one in eight people worldwide. And the human population is still growing. By 2050 there will be another 2.4 billion mouths to feed. We will have to increase the amount of food we produce by 70 percent to meet the extra demands placed by population growth and changes in diets.

Climate change will affect agriculture through higher temperatures, greater crop water demand, more variable rainfall and extreme climate events such as heat waves, floods and droughts. Marginal areas, where low yields and poverty go hand in hand, may become even less suited for agriculture as a result of land degradation through deforestation, wind and water erosion, repetitive tillage and overgrazing. Many impact studies point to severe crop yield reductions in the next decades without strong adaptation measures — particularly in Sub-Saharan Africa and South Asia, where rural households are highly dependent on agriculture and farming systems are highly sensitive to temperature increases and extreme climatic events.

Managing the risks associated with increasingly variable climate is key to successfully adapting agriculture, and to reducing the vulnerability and dependence brought about by climate-related risks and consequently the poverty. Innovations in climate risk management offer win-win opportunities that contribute immediately to agricultural development and improving food security, while building agricultural resilience to changing climates. These include adaptive management in response to seasonal climate forecast, weather index insurance, and improved early warning and early response systems along with other practices.

It is true that globally agricultural production could be significantly improved adopting various measures but the residual risk from the natural hazards still affecting agricultural sector enormously. As already mentioned, in the changing climate it might aggravate further. In view of tiny and scattered landholdings in India, index based crop insurance is considered to be the most effective tool to minimize losses in the event of climatic variability. Over the years, a number of agricultural insurance products were developed and promoted by the government. In recent years, private sector and non-governmental organizations were also engaged in agricultural insurance sector. Despite concerted efforts by the public and private sector, agriculture insurance is not as attractive and successful as general, life and health insurance. Lack of location specific insurance contracts, very little awareness, absence of transparency, and delay in getting claims are being cited key obstacles in large-scale acceptance of agricultural insurance by the famers. On the other hand livestock fodder is affected with the scarce rainfall in the arid and semi-arid districts. Hence, a pilot program is planned to address the issues discussed above.

Based on the agro-climatic nature, sensitivity and rainfall dependent agriculture, two villages are selected (viz., V. Bonthiralla and Yerraguntla) in Dhone Mandal of Kurnool. Villages-wise details are given in Table 1, their spatial distribution and weather stations are shown in images 1-3. Historically, Dhone is a drought prone mandal in AP state with very scanty annual rainfall (with mean annual rainfall 360 mm).

Table 1. Pilot villages

Sr. No.	State	District	Block / Mandal	Village	Geo-Coordinates	
					Latitude (N)	Longitude (E)
1	AP	Kurnool	Dhone	V. Bonthirala	15°25'27"	77°42'19"
2	AP	Kurnool	Dhone	Yerraguntla	15°23'7"	77°55'54"

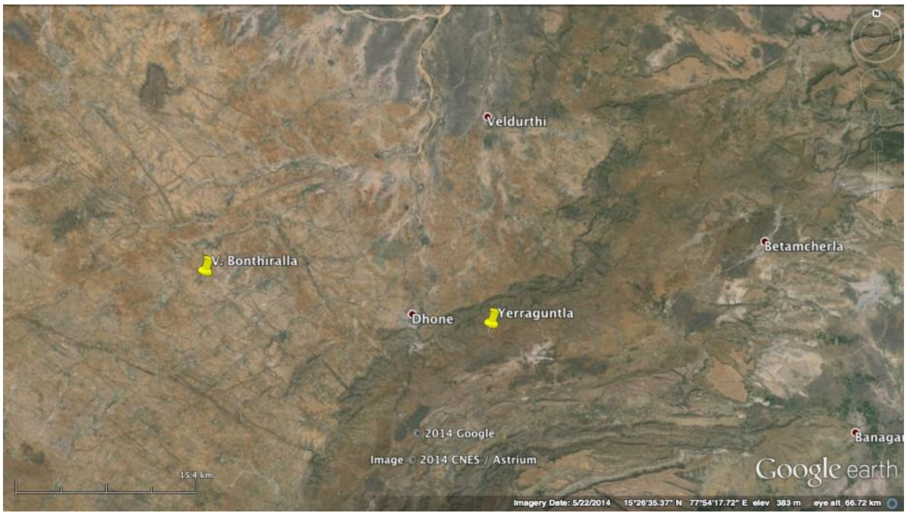

Image 1. Picture showing pilot locations in Kurnool district, Andhra Pradesh.

II. Pilot Project Partners

A. International Water Management Institute: Resource and Knowledge partner
B. Farmers: Insured partners
C. Bajaj Allianz General Insurance Company: Underwriting partner
D. eeMAUSAM: Product implementation partner

III. Project Implementation

In continuation of previous year's pilot program, current year pilot is implemented after revising the contract structure. This is because the farmers from Yerraguntla gave the feedback that phase-wise cumulative rainfall structure could be better to assure well distributed rainfall in turn will help in continuity of fodder availability. After monitoring and evaluation of 2014 years contract and payout analysis, following implementation process is followed.

Step 1: Monitoring and Evaluation to revise the contract

After successful implementation of first year's (Kharif 2014) weather index insurance program, it was observed by all the stakeholders including famers that phase-wise cumulative rainfall could better to address the fodder availability in open grazing lands. This will help in addressing the both quantum of rainfall and well distribution of rainfall during the monsoon season. Hence, Bajaj Allianz has agreed to revise the term-sheet as per the request from implementation partners and farmers

Step 2: Contract Pricing

Following the contract design, the next step is to undertake the detailed contract pricing process, or if working with a reinsurer, develop term sheets and spread-sheets that allow the reinsurer to price the contracts. There is a need to take into account loadings such as commissions and taxes, and there may also be a need to do activity based costing with the contract distributor to find out what their administrative loadings should be there. Bajaj Allianz prepared the revised contract pricing and term-sheet for implementation.

a. Premium calculation

Insurance provides a mechanism to exchange contingent future loss reimbursements against fixed payments – premiums. The actuarial rationale for the determination of premiums is that these need to be sufficient to cover future losses on average. The equivalence principle is derived from this rationale as the origin for pricing insurance risks and defines the pure insurance premium as such that the present value of premiums is equal to the present value of expected losses. For the fundamental approach of pricing insurance risk assume that total losses 'X' from an insured risk in a specified time period are produced by a stochastic process. The insurer has no or only limited influence on the random variable 'X', with mean 'μ' and standard deviation 'σ'. Since it is the objective of an insurance mechanism to define insurance cover and the corresponding premium 'π' prospectively, it is necessary to provide an estimate of 'π' in advance. Thus, the expectation on mean of the losses 'μ', a point estimate, is included in the actuarial pure insurance premium. Since future losses are random and thus not known with certainty and the premium 'π' is set prospectively. The pure insurance premium may not be sufficient to cover all losses and costs in the future with a certain probability. However, insurer can control the risk of insolvency 'α' by adding a risk-loading 'θ' to the premium that is dependent on the distribution of losses 'X'. The required actuarial premium 'π' for insurance risks that controls for risk of insolvency 'α' is hence defined by $\pi = (1+\theta)\ \mu$.

The risk-loading 'θ' can be derived by various principles, all of which aim at limiting the risk of insolvency to a sufficiently small value. If a large enough number of insured '*n*' is assumed, the central limit theorem yields $\theta = (z1 - \alpha\sigma)/(\mu\sqrt{n})$. Assuming the number of insured being independent of the premium, the insurer may control the risk of insolvency by increasing the risk-loading 'θ' to a sufficient level. Beside the total costs of future losses, the insurer has significant additional costs originating in the organization (e.g., distribution, management, settlement) and from financing of the organization, i.e., cost of capital. These costs need to be generated from premium income and are reflected in a cost-loading 'c' that equals the present value of expected costs. Thus, the required actuarial premium 'π' for insurance risks controlling for risk of insolvency and including cost is $\pi = (1+\theta)\ \mu + c$.

The premium for the study area was assessed using the above equation. The term sheets were tested for the Kharif 2014 and revised for the year 2015. Trigger points have been decided on the basis of the average weather conditions in the mandal for the last 20-25 years. Premium rate have been arrived by adding the risk cost with the risk loading and management expenses. The detailed term sheet for the fodder crop is presented below

b. **Term Sheet for livestock fodder:**

- District: Kurnool
- Mandal: Dhone
- Village 1: V. Bonthirala, 2: Yerraguntla
- Reference: AWS maintained by ICRISAT & Team
- Projected average rainfall for Dhone: 360 mm

- Cover period: 16th July to 31st October 2015
- Sum Insured: Rs. 5,000/acre
- Premium: Rs. 500/- + Taxes at 14%.

Pay-out Structure:

Index: Cumulative Rainfall in the defined phases

Phase	From	To	Benchmark Rainfall (mm)	Phase-wise sum insured (Rs)
Phase 1	15/07/2015	31/08/2015	110	2000
Phase 2	01/09/2015	30/09/2015	50	1500
Phase 3	01/10/2015	31/10/2015	35	1500

Phase wise deficit rainfall from the benchmark	Payout (%)
20-30%	10%
30-50%	30%
50-75%	70%
> 75%	100%

Step 3: Development of Contract Administration Tool Kit

A number of tools have to be developed including contract workflows, contract manuals, and contract monitoring sheets - a spreadsheet where users input i.e., weather data received from the weather stations, and a recording of whether a pay-out has been generated or not. The sheet is developed and agreed with all stakeholders and is password protected to ensure the spreadsheet is not corrupted.

Step 4: Client Education

It is a normal practice to develop printed materials to be used by field officers to train the farmers about the principles of insurance, premiums and claims process. In many cases where insurance is introduced, there is a general lack of knowledge among farmers, and often a mistrust of insurance. These objections have to be overcome.

Experience has shown that one of the most effective ways of developing such tools is a organize focus group meetings where the contract is explained and stakeholders are requested to identify the features they think should be communicated to farmers. Ideally, these meetings should include some of the participating farmers as they can provide a valuable perspective on what their colleagues can understand and value. We organized training programs in all the villages and explain about crop insurance procedures and discussed the insurance contract that is going to be implemented in respective villages.

Step 5: Farmer Recruitment

Once the contract is ready, key staff and field officers undertake training of trainer (ToT) sessions in order that they can then provide the necessary education at client level. They then hold client-training meetings and identify and register interested farmers (Annexure I).

We trained the local NGOs, who are already working in the villages to educate the farmers and explain about the program. NGO staff also helped us in enrolment of farmers and premium collection.

Table 2. Pilot project statistics

Villages	V. Bonthiralla	Yerraguntla	Total
No. Farmers	25	25	**50**
No. Acres	25	25	**50**
Total Sum Insured (Rs)	125,000/-	125,000/-	**250,000/-**
Total Premium (Rs)	14,250/-	14,250/-	**28,500/-**

Step 6: Risk Transfer

It is necessary that the Memorandum of Understandings (MoUs) should be signed with key stakeholders and especially the data providers to ensure appropriate and timely data delivery to all concerned parties. The contract distributor then uses the farmer register to develop premium schedules, which can be forwarded to the insurer.

Premium of Rs. 28,500 that is collected from 50 farmers in two villages was paid to the insurer and policies issued by the insurer were distributed among the farmers.

Step 7: Contract Monitoring

Contract monitoring sheets and other product tools were distributed to relevant stakeholders who were obliged to enter appropriate data during the contract period. Weather data from Automatic Weather Stations (AWS) was provided by ICRISAT in both the villages. Weather data recorded during the contract period is presented in Annexure II.

Observations for Weather Index Contract

It is revealed from the rainfall table (Annexure II) that V. Bonthiralla AWS received total rainfall of 29.6 mm during the phase 1 (15th July to 31st Aug.) and Yerraguntla AWS received total rainfall of 108.5 mm during the same period. While in phase 2 and 3, both V. Bonthiralla and Yerraguntla received 24.6 mm and 151.4 mm; and 1.0 and 2.6 mm respectively. V. Bonthiralla received less rainfall during all three phases.

Table 3: Rainfall received in the three phases

Village	Phase 1 (15 July – 31 Aug.)			Phase 2 (1 – 30 Sept.)			Phase 3 (1 – 31 Oct.)		
	Cum. RF mm	% Deficit	Payout	Cum. RF mm	% Deficit	Payout	Cum. RF mm	% Deficit	Payout
Bonthiralla	29.6	73	1400	26.4	47	450	1.0	97	1500
Yerraguntla	108.5	1	Nil	151.4	Nil	Nil	2.6	93	1500

There was a deficiency of total rainfall up to the tune of 97% in V. Bonthiralla, while it is up to 93% in Yerraguntla during phase 3. As per the term-sheet, each farmer in V. Bonthiralla will receive a total of Rs. 3350/- per acre and in Yerraguntla, each farmer will receive Rs. 1500/- as this location received deficit rainfall.

Step 8: Claim Process

If a claim has been generated, the contract-monitoring sheet will reveal the amount, and insurer will make the payments directly to the insured farmers within an agreed period mentioned in the Product Note. Such payments could directly go to the bank accounts of the insured farmer to reduce the transactions cost and make delivery faster.

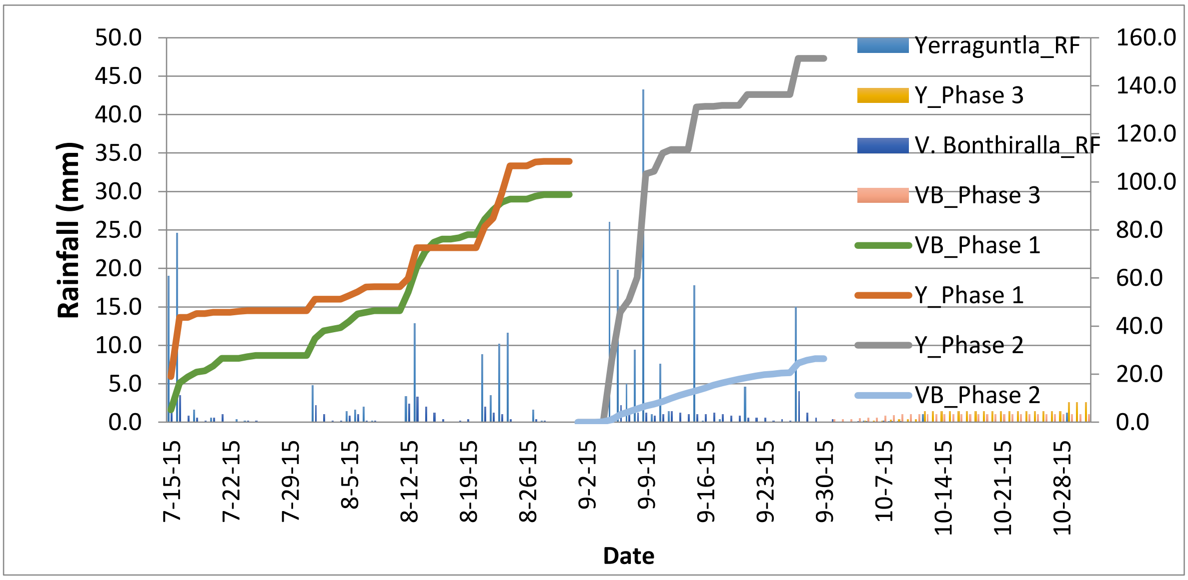

Figure 1. Rainfall (mm) recorded in V. Bonthiralla and Yerraguntla villages, Kurnool district during the project period.

The contract period for fodder insurance that we piloted in Kurnool district was matured by 31st October 2015. As per the term-sheet, there is a claim in V. Bonthiralla and Yerraguntla villages. Farmers of V. Bonthiralla will receive Rs. 3350/- per acre as the deficit rainfall falling in all the categories range. Whereas in case of Yerraguntla, deficit rainfall received only during phase 3, which is 93%. Hence, each farmer in Yerraguntla will receive Rs. 1500/- for the deficit rainfall to the tune of 93%.

IV. Conclusion

It was observed that there is need to take the distribution of rainfall into account especially the longer dry spells to calculate the amount of payouts. This would help in situations when there is a large rainfall over a week followed by dry spell of 20 days or more in a month with hot and extremely dry conditions like last year. The weather scenarios could affect forage yields but wouldn't necessarily trigger a claim payment because the monthly rainfall average could be close to the historical average. Hence, farmers wanted revised contracts with cumulative rainfall over shorter intervals.

Annexure – I: List of farmers

A. List of farmers enrolled in V. Bonthiralla Village under Fodder Insurance Program

S. No.	Name of the Farmer	Area in Acres	Syrvey No.	Sum Insured (Rs.)	Premium (Rs.)
1	T. Chinna Sunkanna	1	440	5,000/-	500/-
2	Madiga Madanna	1	475	5,000/-	500/-
3	Talari Pedda Sunkanna	1	440/2	5,000/-	500/-
4	Kottamu Nayudu	1	607	5,000/-	500/-
5	Kotla Maddileti	1	471	5,000/-	500/-
6	Kotla Venkateswarlu	1	471/1	5,000/-	500/-
7	Kotla Chandraiah	1	472	5,000/-	500/-
8	Kotla Sunkappa Seemala	1	556/2	5,000/-	500/-
9	S. Ganamaddaiah	1	581	5,000/-	500/-
10	S. Sunkappa	1	581	5,000/-	500/-
11	Madiga (Harijana) Sunkanna	1	461/5	5,000/-	500/-
12	Kurim Surendra	1	476	5,000/-	500/-
13	Talari Naidu	1	535	5,000/-	500/-
14	T. Thimmaiah	1	534	5,000/-	500/-
15	T. Muddulu	1	468	5,000/-	500/-
16	D. Madhanna	1	543	5,000/-	500/-
17	E. Srinivasulu	1	526	5,000/-	500/-
18	T. Balamaddaiah	1	926	5,000/-	500/-
19	P. Ramamohan	1	353	5,000/-	500/-
20	E. Ramakrishna	1	523	5,000/-	500/-
21	T. Surendra	1	352	5,000/-	500/-

22	T. Sunkappa	1	533	5,000/-	500/-
23	B. Siva Kumar	1	363	5,000/-	500/-
24	G. Srinivasulu	1	445	5,000/-	500/-
25	T. Dhanunjayudu	1	535	5,000/-	500/-

B. List of farmers enrolled in Yerraguntla Village under Fodder Insurance Program

S. No.	Name of the Farmer	Area in Acres	Syrvey No.	Sum Insured (Rs.)	Premium (Rs.)
1	K. Obulesh	1	680	5,000/-	500/-
2	M. Mareppa Naidu	1	674	5,000/-	500/-
3	Boya Balanagamma	1	1213/2	5,000/-	500/-
4	Akumalla Pedda Giddanna	1	701	5,000/-	500/-
5	Sandu (Gundralla) Venkatramudu	1	674	5,000/-	500/-
6	Sandu Narayana	1	676	5,000/-	500/-
7	Anchakattu Balaraju	1	1243/A	5,000/-	500/-
8	Sandu Vijaybhaskar	1	678/12	5,000/-	500/-
9	Aala Sreeramulu	1	690	5,000/-	500/-
10	Racharla Ramasubba Reddy	1	683/A.2	5,000/-	500/-
11	Uluva Rangamma	1	702/91	5,000/-	500/-
12	Anchakatti Nageswara Naidu	1	1230/2	5,000/-	500/-
13	Sandhu Giddaiah	1	52/2	5,000/-	500/-
14	Uluva Venkatramudu	1	1229/1	5,000/-	500/-
15	Anchakatta Baludu	1	701/11	5,000/-	500/-
16	Gandham Nageswara Rao	1	650/A.2	5,000/-	500/-

17	Anchakatti Thimmaiah	1	702/C	5,000/-	500/-
18	Sandhumulinti Devappa	1	671	5,000/-	500/-
19	Mulinti Ramachandrudu	1	689/8	5,000/-	500/-
20	Bogulu Pullaiah	1	634	5,000/-	500/-
21	Aavula Boya Pedda Thimmaiah	1	667/3	5,000/-	500/-
22	Sandhu Subbamma	1	641/1	5,000/-	500/-
23	Talari Lakshmi Devi	1	634	5,000/-	500/-
24	Gurrampogu Venkat Lakshmamma	1	688/9	5,000/-	500/-
25	Uluva Venkateswarlu	1	1229/2	5,000/-	500/-

Annexure II – Weather data for action sites:

Date	Yerraguntla_RF	V. Bonthiralla_RF	Date	Yerraguntla_RF	V. Bonthiralla_RF
15/07/15	19.0	1.6	07/09/15	5.0	1.2
16/07/15	24.6	3.5	08/09/15	9.4	1.2
17/07/15	0.0	0.8	09/09/15	43.2	1.2
18/07/15	1.6	0.6	10/09/15	1.0	0.8
19/07/15	0.0	0.2	11/09/15	7.6	1.0
20/07/15	0.6	0.6	12/09/15	1.4	1.4
21/07/15	0.0	1.0	13/09/15	0.0	1.2
22/07/15	0.0	0.0	14/09/15	0.0	1.0
23/07/15	0.4	0.0	15/09/15	17.8	1.0
24/07/15	0.2	0.2	16/09/15	0.2	1.0
25/07/15	0.0	0.2	17/09/15	0.0	1.2
26/07/15	0.0	0.0	18/09/15	0.4	1.0
27/07/15	0.0	0.0	19/09/15	0.0	0.8
28/07/15	0.0	0.0	20/09/15	0.0	0.8
29/07/15	0.0	0.0	21/09/15	4.6	0.6
30/07/15	0.0	0.0	22/09/15	0.0	0.6
31/07/15	0.0	0.0	23/09/15	0.0	0.6
01/08/15	4.8	2.2	24/09/15	0.0	0.2
02/08/15	0.0	1.0	25/09/15	0.0	0.4
03/08/15	0.0	0.2	26/09/15	0.0	0.2
04/08/15	0.0	0.2	27/09/15	15.0	4.0
05/08/15	1.4	0.8	28/09/15	0.0	1.2
06/08/15	1.6	1.0	29/09/15	0.0	0.6
07/08/15	2.0	0.2	30/09/15	0.0	0.0
08/08/15	0.2	0.2	01/10/15	0.0	0.4
09/08/15	0.0	0.0	02/10/15	0.0	0.0
10/08/15	0.0	0.0	03/10/15	0.0	0.0
11/08/15	0.0	0.0	04/10/15	0.0	0.1
12/08/15	3.4	2.4	05/10/15	0.2	0.1
13/08/15	12.8	3.3	06/10/15	0.0	0.0
14/08/15	0.0	2.0	07/10/15	0.0	0.2
15/08/15	0.0	1.2	08/10/15	0.1	0.1
16/08/15	0.0	0.4	09/10/15	0.1	0.1
17/08/15	0.0	0.0	10/10/15	0.0	0.0
18/08/15	0.0	0.2	11/10/15	0.0	0.0
19/08/15	0.0	0.4	12/10/15	1.0	0.0
20/08/15	0.0	0.0	13/10/15	0.0	0.0
21/08/15	8.8	2.0	14/10/15	0.0	0.0
22/08/15	3.5	1.2	15/10/15	0.0	0.0
23/08/15	10.2	1.0	16/10/15	0.0	0.0
24/08/15	11.6	0.4	17/10/15	0.0	0.0
25/08/15	0.0	0.0	18/10/15	0.0	0.0
26/08/15	0.0	0.0	19/10/15	0.0	0.0
27/08/15	1.6	0.4	20/10/15	0.0	0.0

28/08/15	0.2	0.2	21/10/15	0.0	0.0
29/08/15	0.0	0.0	22/10/15	0.0	0.0
30/08/15	0.0	0.0	23/10/15	0.0	0.0
31/08/15	0.0	0.0	24/10/15	0.0	0.0
01/09/15	0.0	0.0	25/10/15	0.0	0.0
02/09/15	0.0	0.0	26/10/15	0.0	0.0
03/09/15	0.0	0.0	27/10/15	0.0	0.0
04/09/15	0.0	0.2	28/10/15	0.0	0.0
05/09/15	26.0	0.8	29/10/15	1.2	0.0
06/09/15	19.8	2.2	30/10/15	0.0	0.0
			31/10/15	0.0	0.0

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