Oil Well Production Treatment

General Procedure

The procedure described herein represents a general framework. Adjustments may be required based on individual well conditions, crude oil properties, and the specific objectives of the treatment. These factors will determine how the procedure is applied in each case.

Wellbore Cleaning

The objective of wellbore cleaning is to remove organic damage from the near-wellbore region.

As oil-producing wells mature, various flow restrictions can develop. A significant contributor to these restrictions is the precipitation of organic materials in the near-wellbore area. This phenomenon typically results from pressure changes between the reservoir and the wellbore, leading to the precipitation of heavier oil fractions. These deposits can obstruct pore spaces within the flow region, reducing production efficiency.

Revive has developed specialized products and procedures designed to remove organic damage from the formation. The treatment process consists of the following steps:

1. Application of a specialty surfactant capable of releasing and softening hardened organic materials precipitated during production.
2. Application of a specialty solvent compound that dissolves the organic deposits mobilized by the initial chemistry. This solvent also enhances oil-water separation in surface treatment equipment.
3. Injection of displacement fluid to deliver the treatment chemicals to the perforated interval.
4. The calculation of chemical volumes based on, a) pay zone thickness or perforation height, b) porosity of the formation, and c) the desired radius of penetration.
5. The calculation of displacement fluid volume based on a) perforation depth, and b) casing and/or tubing size
6. Controlled pressure variation during injection, where feasible, may be used to induce downhole turbulence and improve treatment effectiveness. This technique must be applied cautiously and is not recommended in sandy shale formations.
7. Once the treatment is injected, the well can be brought back online in 4 to 6 hours.

Well Tubing Maintenance

The objective of well tubing maintenance is to preserve optimal flow conditions within tubing and pipelines, particularly in paraffin-rich crude systems.

Produced fluids may contain insoluble microparticles -- such as clay, silica and asphaltene -- present in the form of colloidal suspensions. However, deposition issues encountered during production operations are caused by compounds that are soluble under downhole conditions. As production fluids rise in the wellbore and experience changes in pressure and temperature, these compounds – primarily salts and paraffins – begin to crystallize. The deposits tend to form and grow in preferential locations, including valves, pumps and rough surfaces. Over time, accumulation can progress to the point of partial or complete plugging of the well. Early reduction or elimination of these deposits is strongly preferred, as fully plugged wells, require costly remediation and result in production delays that last several days.

Revive has developed specialized products to remove paraffin plugs from the lines and to be applied through drip systems to prevent paraffin from crystallizing. These treatments help maintain clear flow paths and ensure uninterrupted production of fluids.

1. Plug Removal
    a. The required chemical volume is calculated based on the estimated volume of paraffin present in the plug.
    b. The chemical treatment is blended with water or a light-weight oil and pumped into the plugged section until the obstruction is dissolved and cleared.
    c. Recirculation may be necessary to fully mobilize and remove the released plugging material from the line.
    d. Heating the chemical blend will expedite the process, although it is not a requirement.
2. Paraffin deposition inhibition:
    a. Volume of chemistry is calculated based on fluid production and paraffin content.
    b. Typical injection rates are 200 to 1,000 ppm.

Use of Colloidal and Specialty Chemistry for Well Treatment

A Technical Bulletin

Issues Addressed

As a well ages, several factors can restrict oil flow in the near-wellbore region. One key factor is the deposition of heavier fractions within the flow zone. This can occur due to changes in fluid pressure, which may alter fluid density sufficiently to cause asphaltenes and other heavy fractions to flocculate and precipitate from solution—commonly referred to as organic damage. This is particularly pronounced when crude oil transitions from an oversaturated state to below the bubble point.

Well stimulation practices, such as acidizing, can further disrupt the equilibrium of the crude oil and trigger asphaltene-related problems. For example, resins may become bound with iron released during stimulation, reducing their availability to stabilize asphaltenes in solution. The resulting deposition can plug pore spaces, restricting flow through the formation. Concurrently, the formation may gradually become more oil-wet, allowing oil to accumulate while water continues to flow, further reducing production efficiency.

Treatment

The treatment involves the injection of custom-designed chemical compounds into the near-wellbore region, typically extending 1 to 3 feet from the borehole, to remove organic deposits and other oil agglomerates. This allows the mixture of colloidal chemistries to penetrate the formation, promoting interaction that reduces capillary forces and improves the mobility ratio. Since the primary flow restriction occurs in the wellbore area, this zone is the main target of the treatment.

A combination of specialty surfactants and colloidal compounds effectively releases organic material from the rock, dissolves the deposits, and alters the formation's wettability to a water-wet state.

The treatment typically requires two to four hours to execute, with the well remaining shut-in for an additional four to six hours afterward. The design and procedure are tailored for each well and oil type. Beyond cleaning the wellbore, this combination treatment can also enhance fluid properties, including viscosity, pour point, and API gravity, among others.

Products

RP530-17 is an active-colloid formulation designed to liberate and desorb oil from a wide range of surface media. It is a water-based blend of anionic, nonabrasive, nontoxic, and mildly alkaline surfactants, containing no solvents. Specifically formulated to remove mineral and petroleum oils, it is also effective against animal and vegetable oils. This multipurpose product enhances cleaning efficiency without toxicity and overcomes the limitations associated with petroleum-based and harsh alkaline cleaners. RP530-17 reduces interfacial surface tension, significantly improving the solution's penetration and its ability to deliver active ingredients deep into the surface media.

RP510-17 is a complex blend of organic solvents, colloidal compounds, and flow improvers, designed to dissolve heavy oil fractions and reduce emulsions. Formulated with minimum VOC technology, it complies with stringent VOC regulations. Typical dosages range from 200 ppm to 2,000 ppm, depending on the

application. When used with other solvents or lighter hydrocarbons, RP510-17 enhances the solvent's ability to dissolve material by breaking down heavier molecules and incorporating them into a lighter fluid, creating a stable oil phase from which the heavy material does not re-precipitate.

Nanotechnology is employed in the synthesis of these chemicals. Nanoparticles are extremely small aggregations of atoms—larger than most molecules but with a high surface-to-volume ratio. Nearly all atoms in a nanoparticle are exposed on the surface, giving them chemical and physical properties distinct from individual molecules or larger aggregates. This allows the construction of engineered blocks and atomic arrangements that enhance the effectiveness and speed of chemical reactions. At the nanoscale, quantum effects can further improve reaction efficiency. In industrial applications, these products often achieve higher purity, improved yields, and energy savings.

Mechanisms

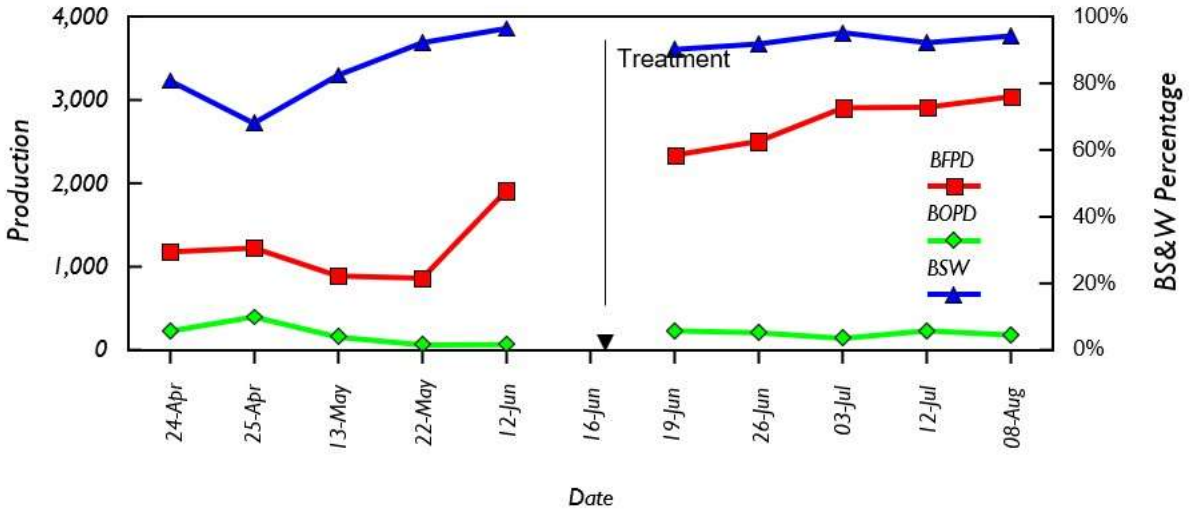
- Reduction of interfacial surface tension
- Surfactants with both oleophobic and hydrophobic functional ends
- Emulsion breaking
- Displacement of hydrocarbons from surfaces and alteration of rock wettability to water-wet

Applications

- Production enhancement (EOR) through paraffin and asphaltene removal
- Viscosity reduction and improvement of fluid flow
- Improvement rock wettability

Treatment Results

Well 143



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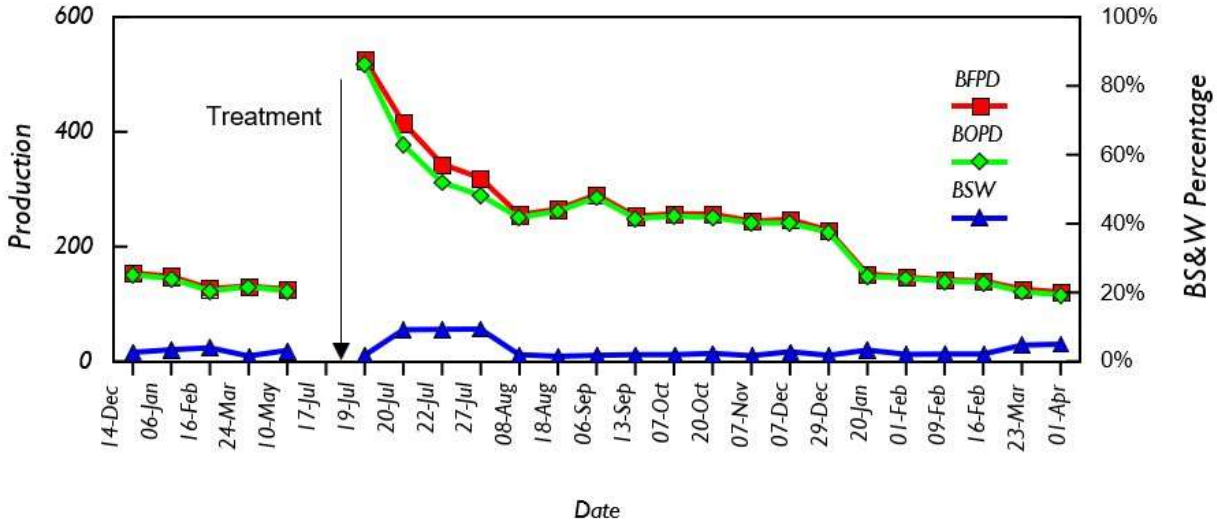

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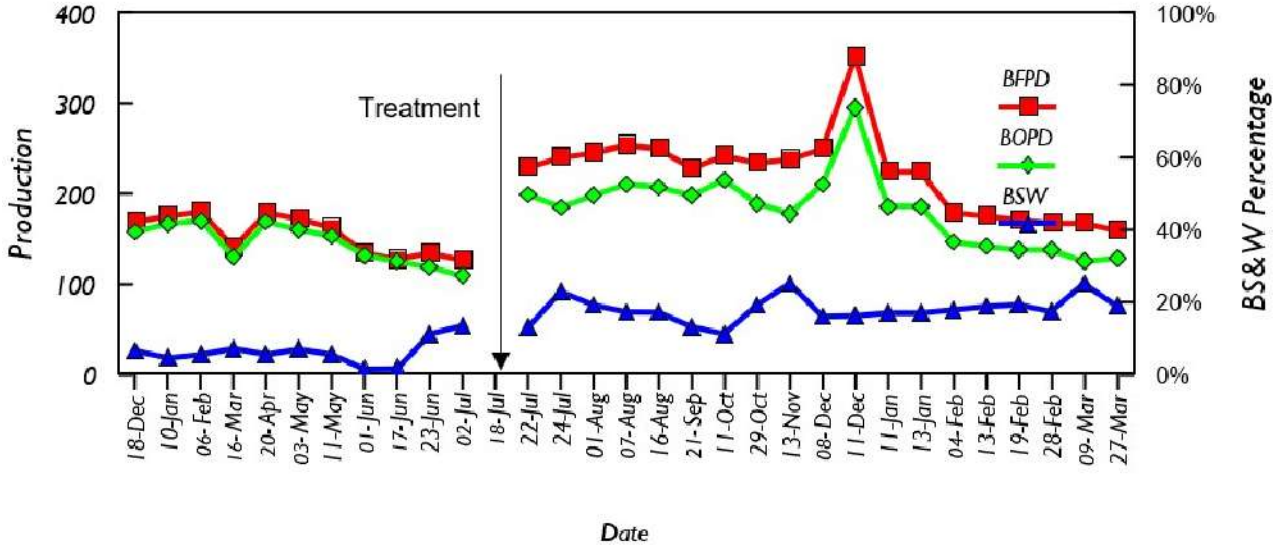

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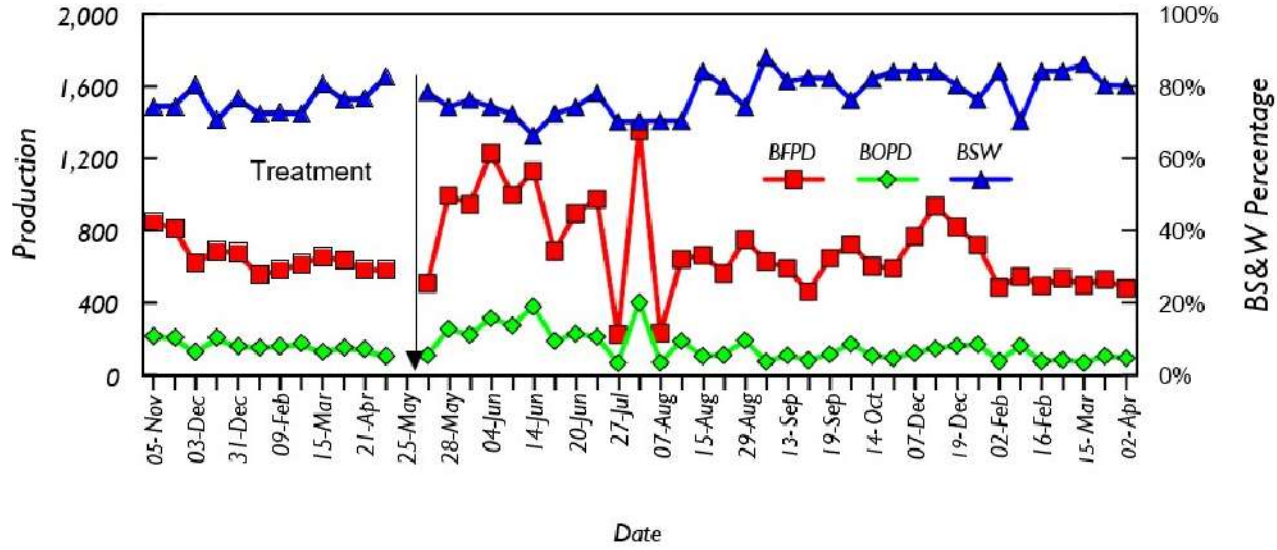

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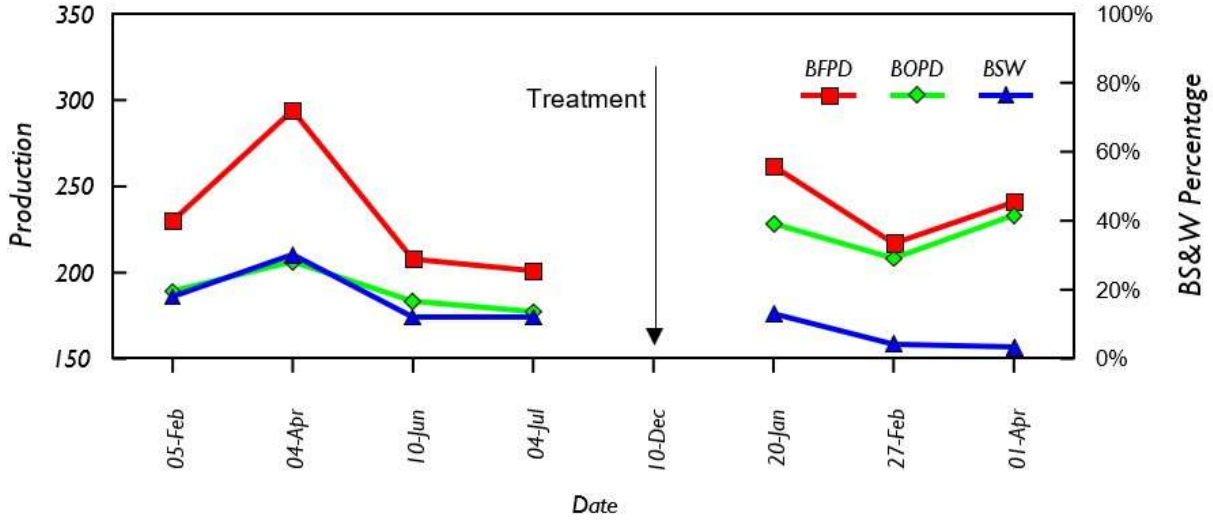

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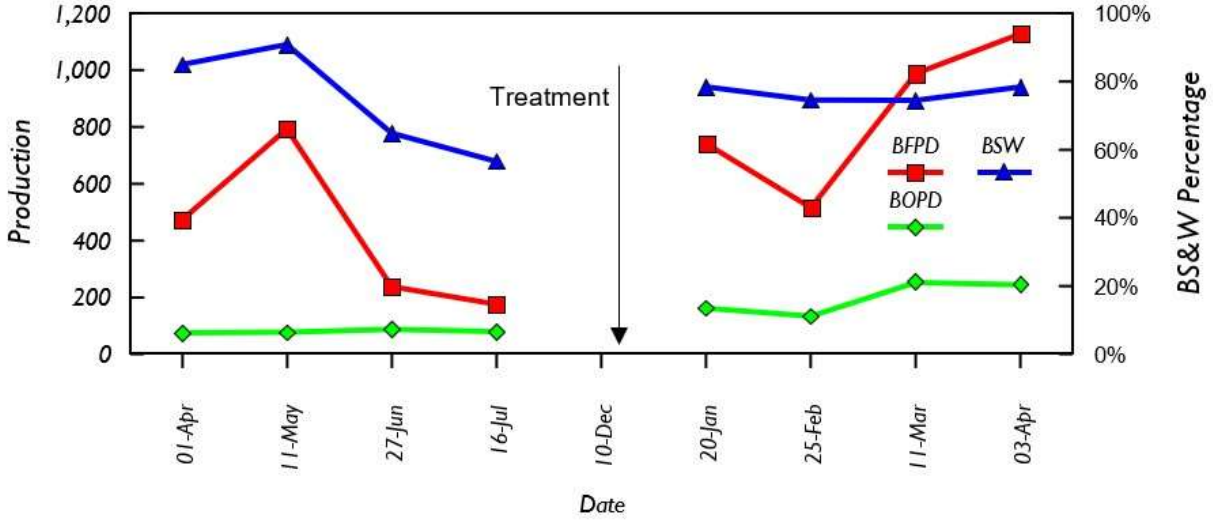

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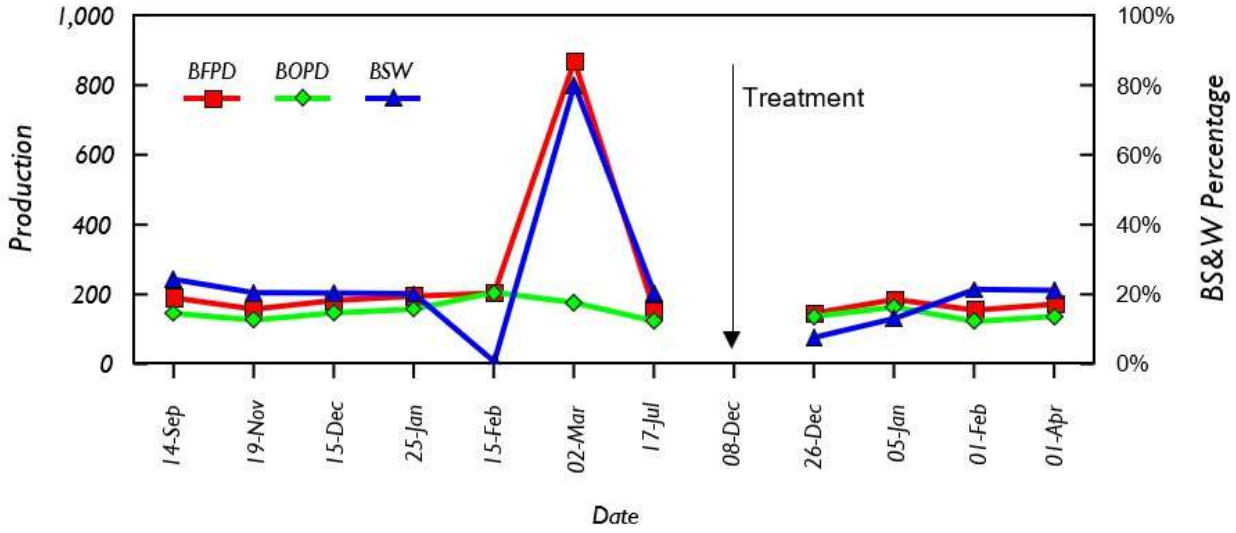

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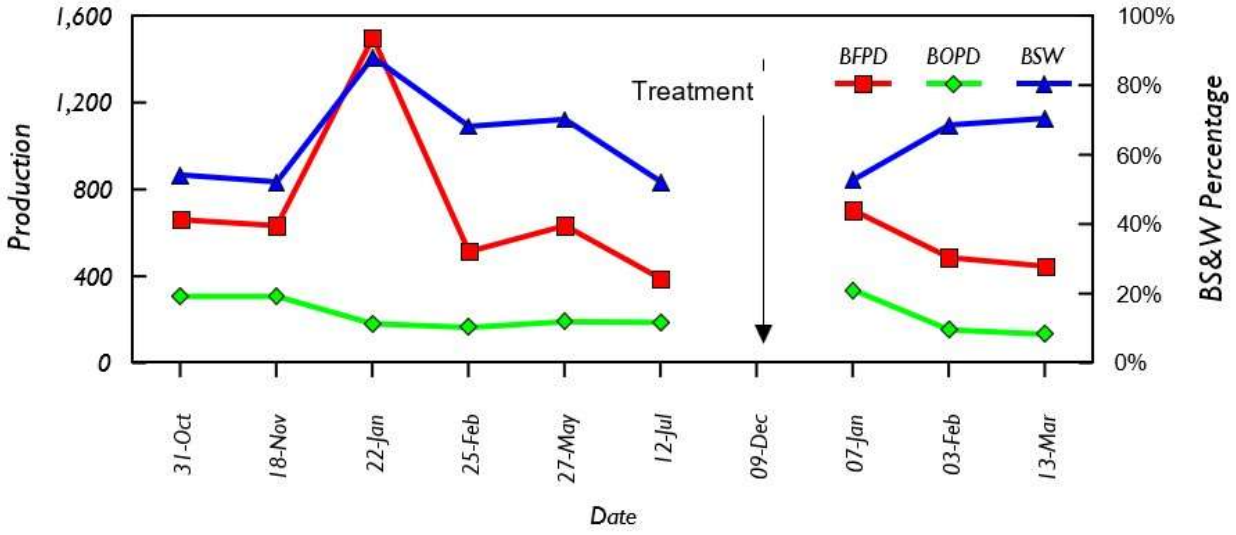

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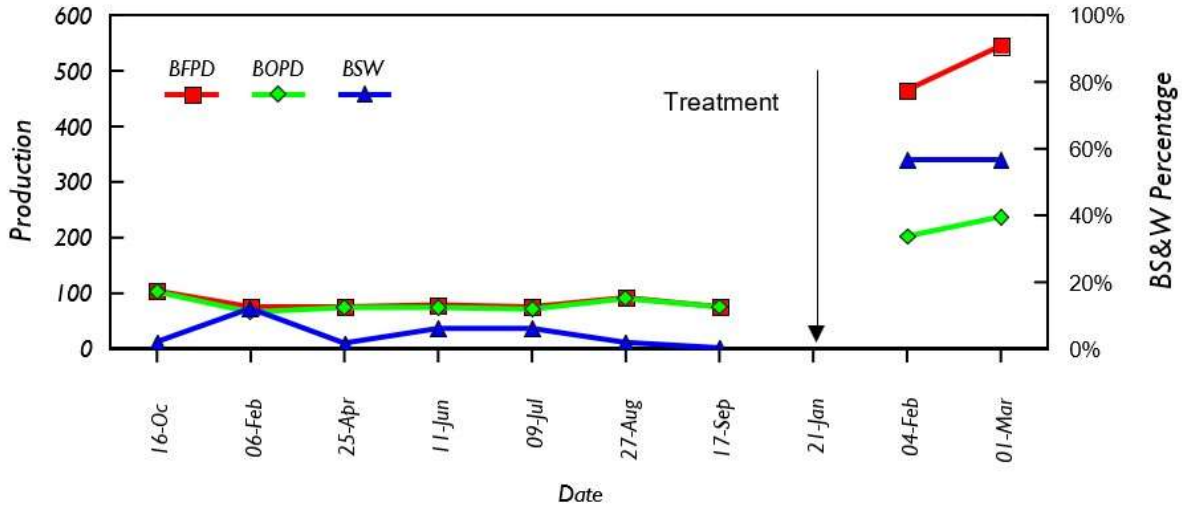

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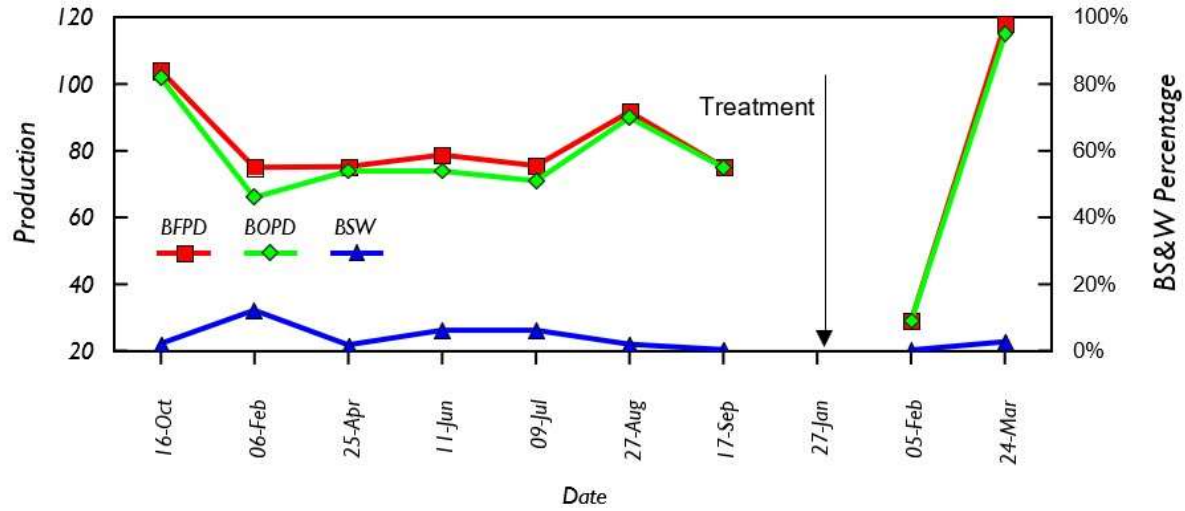

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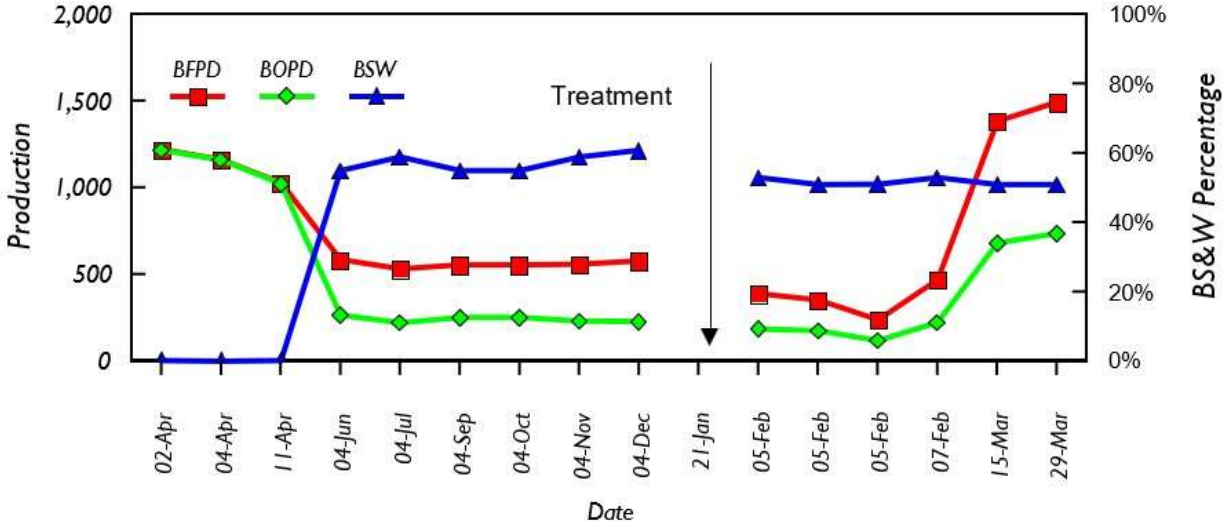

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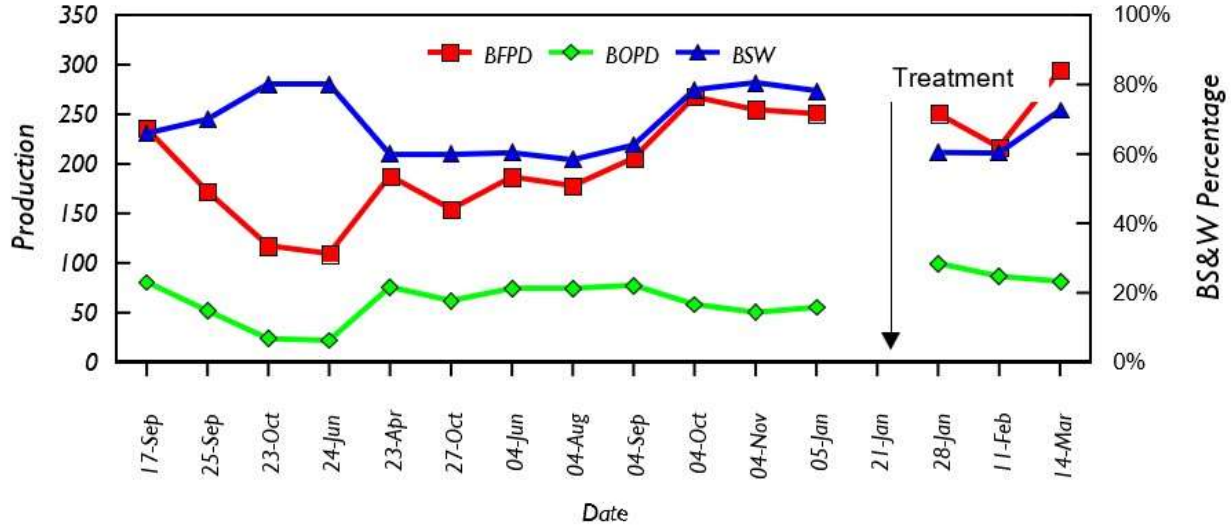

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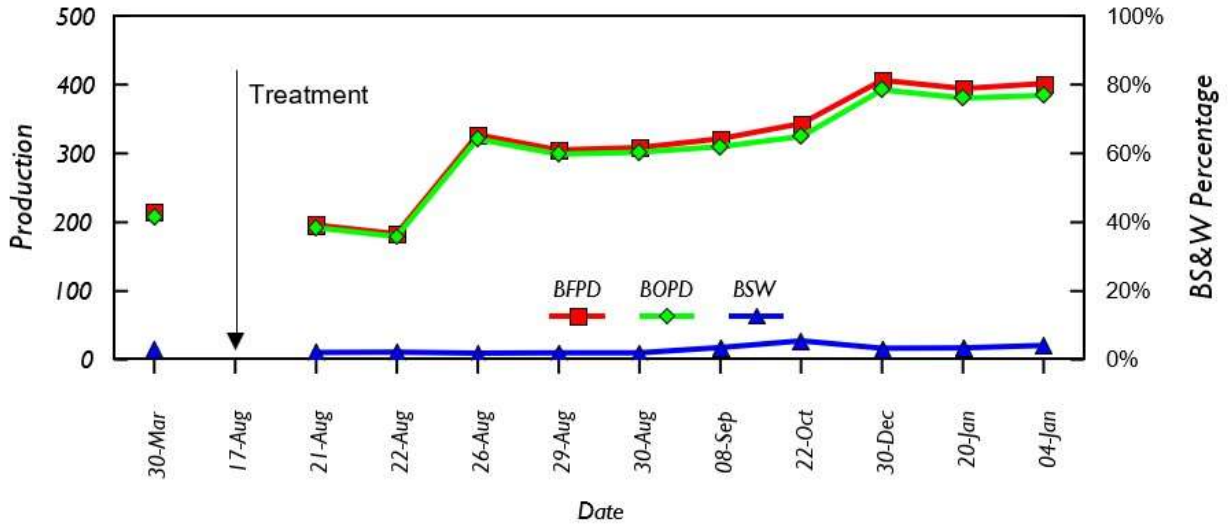

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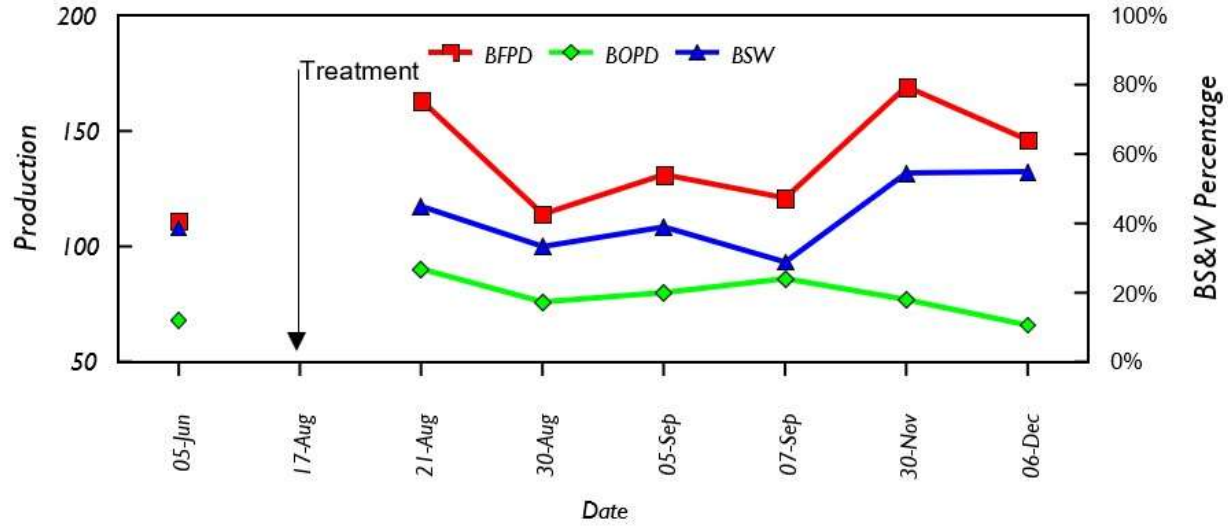

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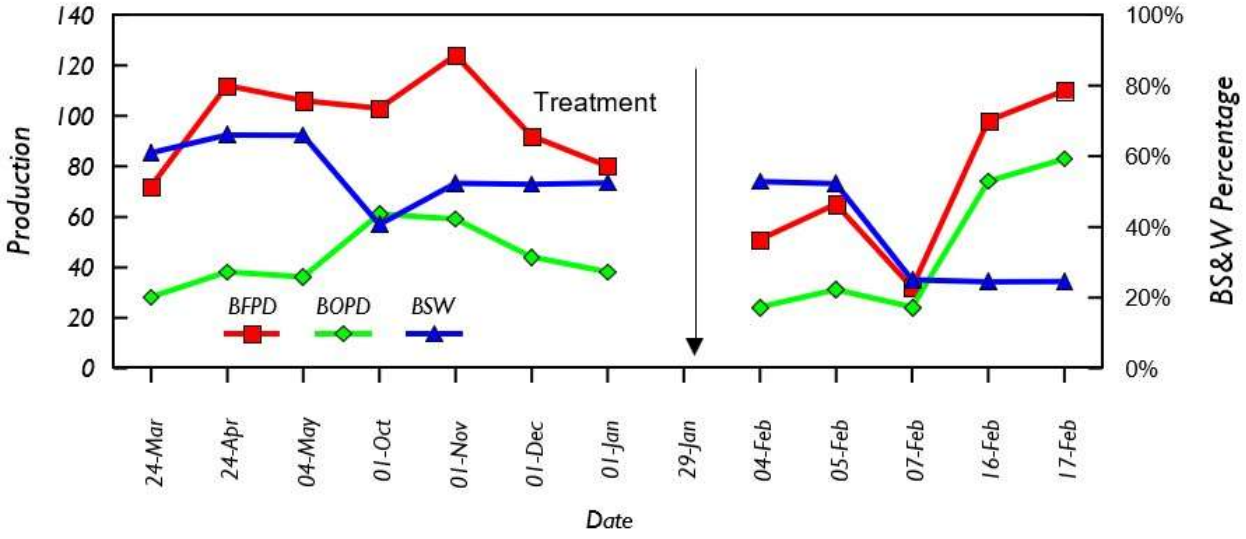

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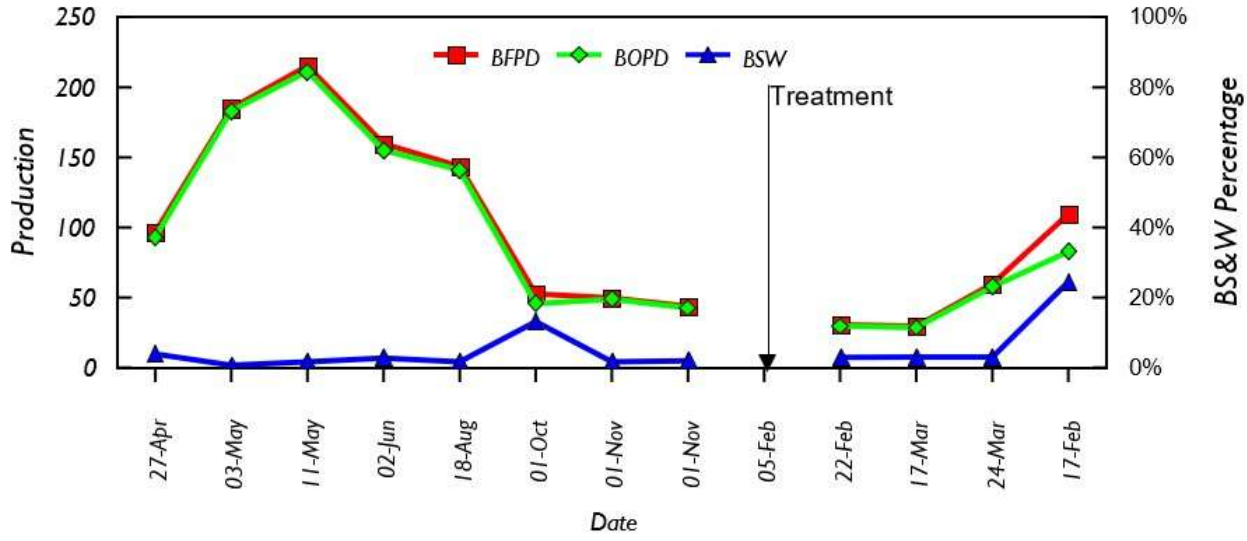

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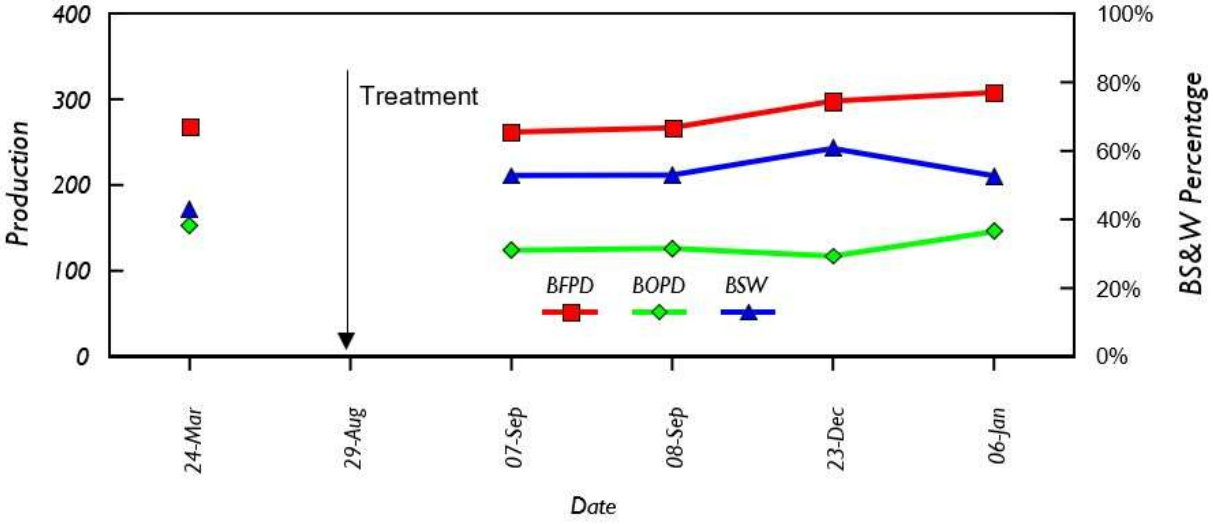

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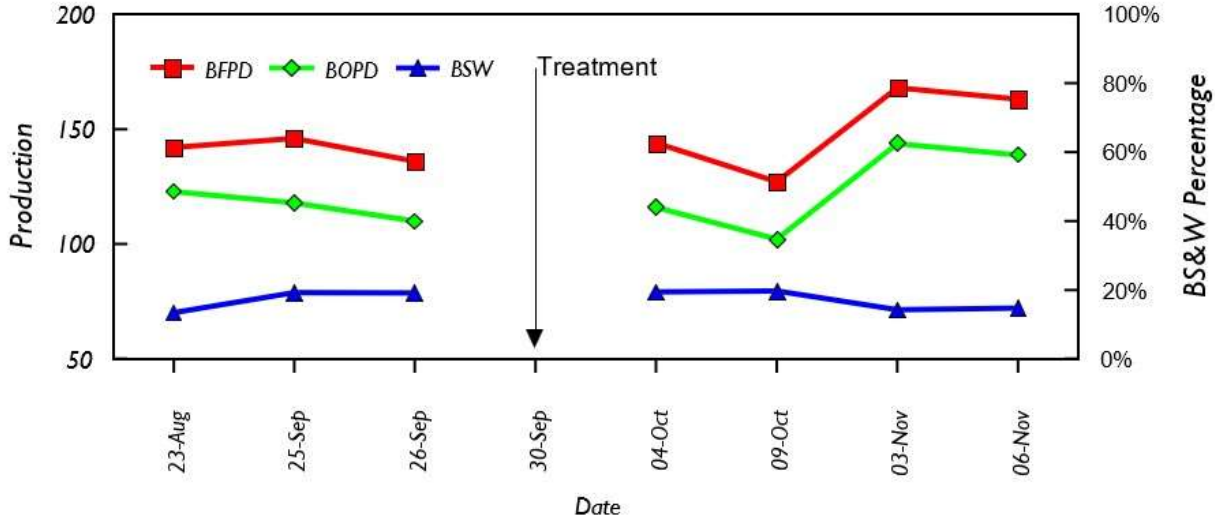

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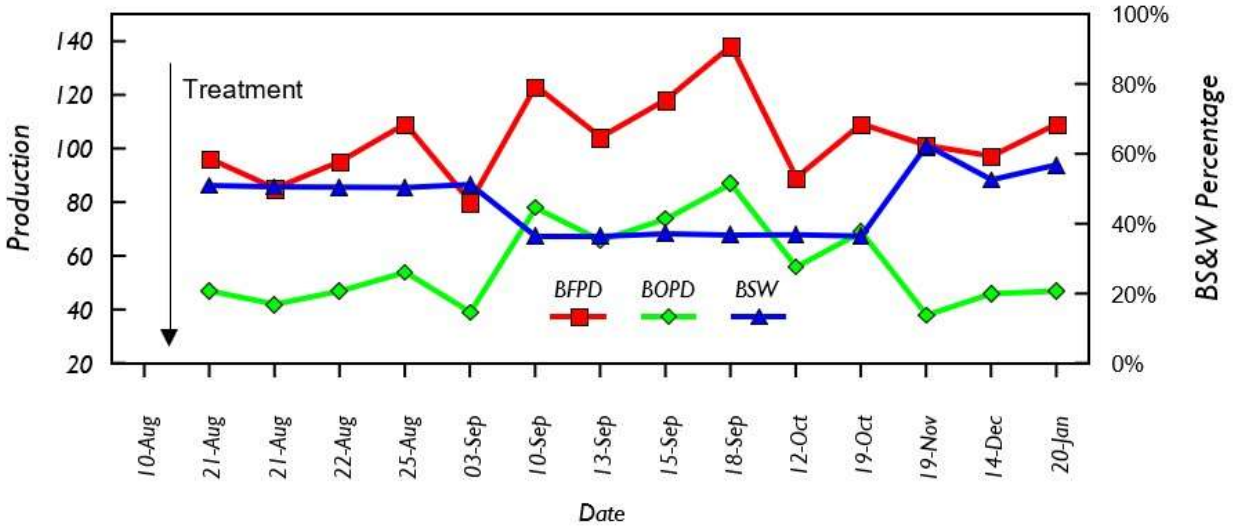

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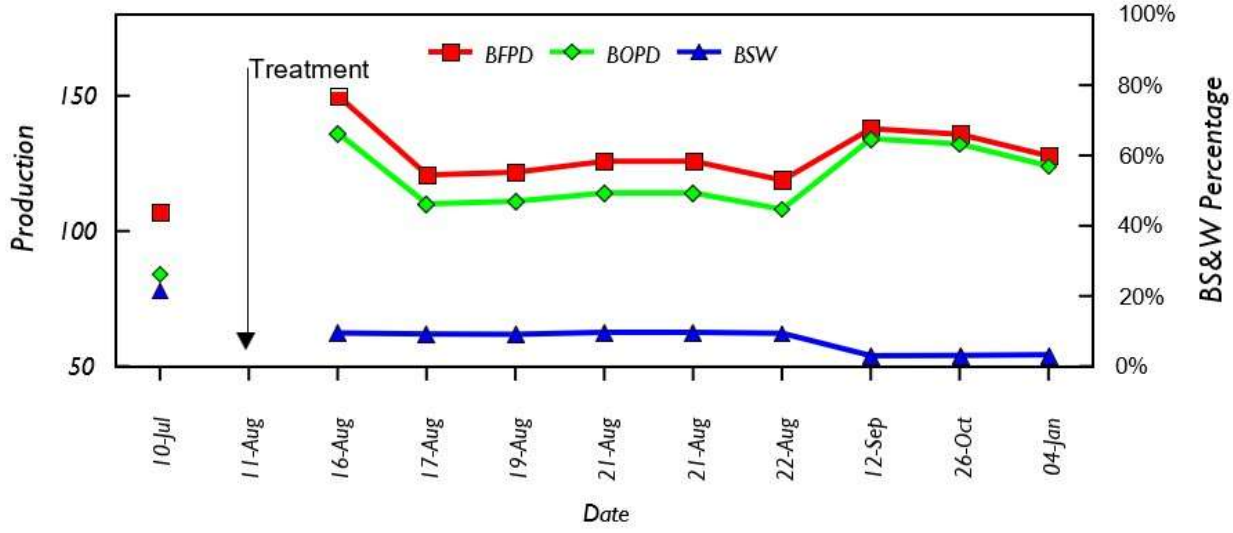
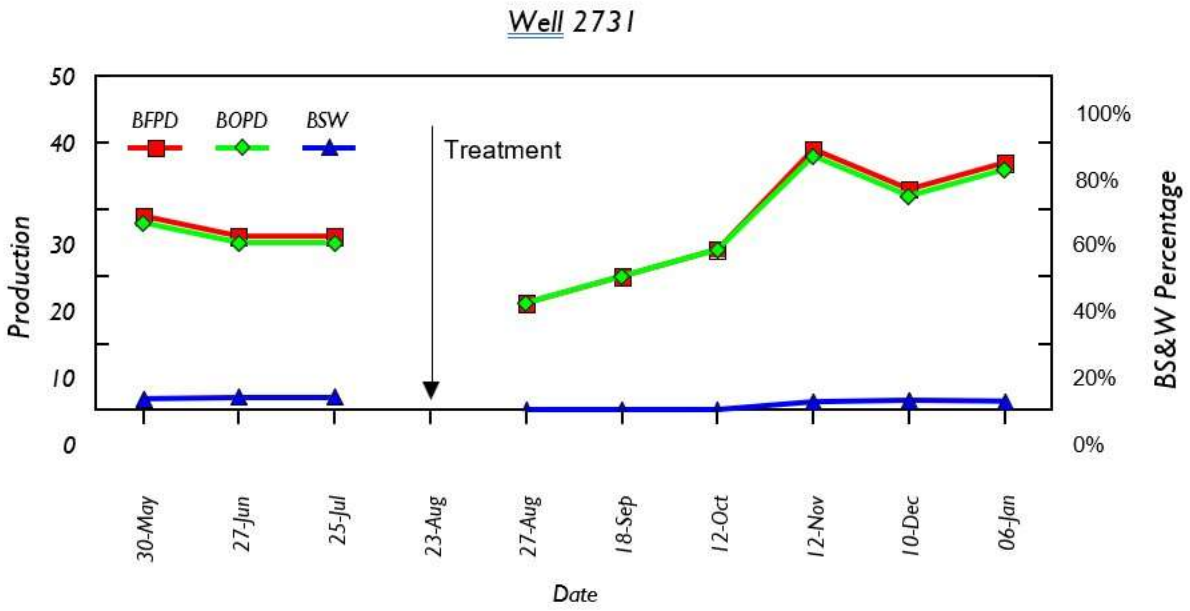
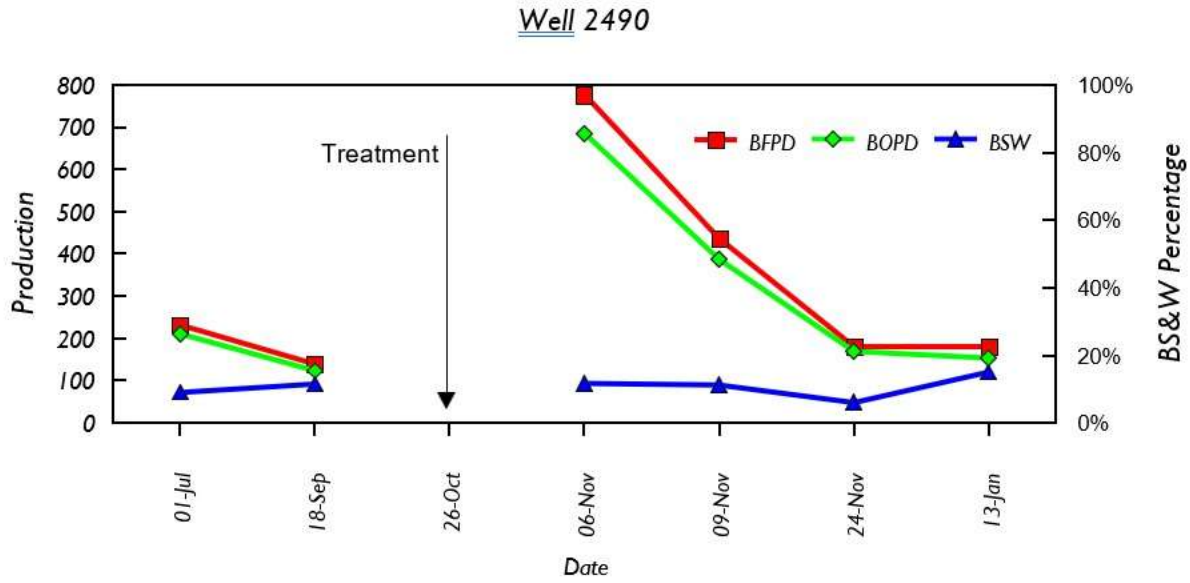



Well 2731
BFPD
BOPD
BSW
Treatment
Production
BS&W Percentage
50
40
30
20
10
0
100%
80%
60%
40%
20%
0%
30-May
27-Jun
25-Jul
23-Aug
27-Aug
18-Sep
12-Oct
12-Nov
10-Dec
06-Jan
Date


Well 2490
Treatment
BFPD
BOPD
BSW
Production
BS&W Percentage
800
700
600
500
400
300
200
100
0
100%
80%
60%
40%
20%
0%
01-Jul
18-Sep
26-Oct
06-Nov
09-Nov
24-Nov
13-Jan
Date

Nano Colloidal and Specialty Chemistry Treatment Results

Well	Date	Production		Change
		Before	After	
0011	08-Dec	123	139	13%
0081	09-Dec	136	206	51%
0381	10-Dec	177	223	25%
0381	10-Dec	77	198	157%
48	09-Aug	47	69	46%
211	11-Aug	84	134	59%
302	17-Aug	215	325	51%
27	17-Aug	68	86	26%
2731	23-Aug	6	36	500%
32	29-Aug	126	146	15%
73	01-Oct	110	144	30%
77	10-Oct	107	220	105%
1871	10-Oct	55	70	27%
6	19-Dec	90	260	188%
0370	21-Jan	75	220	193%
0398	27-Jan	75	72	-4%
0069	21-Jan	226	350	54%
0007	21-Jan	55	89	61%
0324	29-Jan	38	47	23%
0281	05-Feb	43	50	16%
Total Number of Wells			20	
Before Treatment Production (BOPD)			1,933	
After Treatment Production (BOPD)			3,084	
Average Before Treatment Production (BOPD)			97	
Average After Treatment Production (BOPD)			154	
Average Gain (BOPD)			58	
Percentage of Gain			60%	